PMM

Precision Metal Molding

JANUARY
1956

INCLUDING DIE CASTINGS MAGAZINE

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POWDER METALLURGY

SHELL MOLD CASTINGS

SHOTGUN RECOIL STRESSES TO 19,000 PSI . . . ?

"The investment cast breech lock carries most of this chamber pressure."

Carl Benson, Chief Engineer
O. F. Mossberg & Sons, Inc.

See Page 3

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The new Cast-Master Model-M for die casting magnesium, brings to the industry a safer, faster, more economical method for producing magnesium castings than ever before. The machine embodies the same fine features of other Cast-Master die casting machines. The "Dow type" hot end for die casting magnesium is used for metal injection. This end is similar to a zinc hot chamber arrangement thereby eliminating the disadvantage of hand ladling and making high speed production possible.

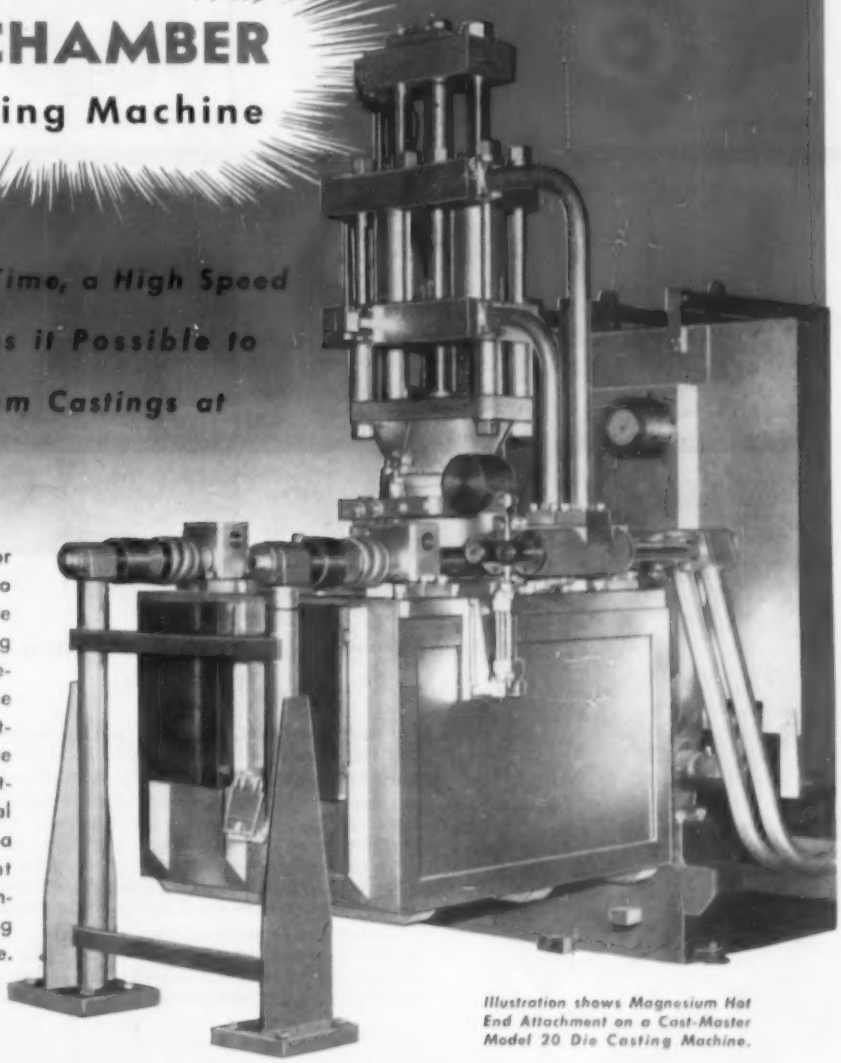
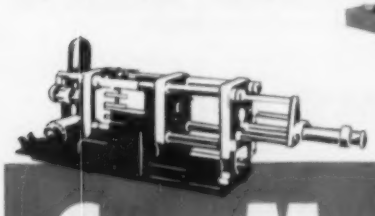


Illustration shows Magnesium Hot End Attachment on a Cast-Master Model 20 Die Casting Machine.



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creative castings

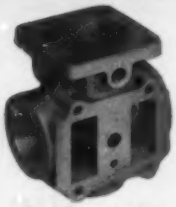
Motor End Frames

Gyrol Fluid Coupling

Garbage Disposer Housing

Aircraft Piston

Torque Converter



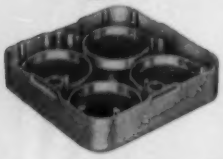
Fuel Pump Body

Carbon Pile Regulator

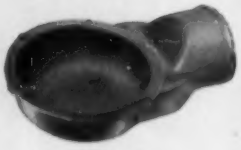
Steel-Belted Piston

Alternator Housing

Diesel Permanent Mold Piston



Rocket Carrier Base



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For many years the foundry of Thompson's Light Metals Division quietly cast thousands and thousands of hard-to-make precision parts in light alloys of aluminum and magnesium for customers in the automotive and aircraft fields.

Then word got around in other industries that Thompson had the experience and facilities to cast light-weight, strong, heat-resisting alloy parts in permanent molds and high pressure dies—which eliminated the weight problems of ferrous counterparts. One by one manufacturers of widely different products came to Thompson for help and advice when they learned that the close tolerances achieved by Thompson cut machining and finishing costs.

Today, our capacity is channeled to top-rated jobs. We're building additional facilities as fast as possible and, in the meantime, Thompson services, as always, are at your command. Our entire staff of creative engineers is ready to help you plan new parts or re-design old ones for the future.

YOU CAN COUNT ON . . .

For a detailed description of the Thompson Light Metals Division operations, send for your free copy of "Creative Castings", "Steel Belted Pistons", detailing this Thompson development, is also available. Just write, on your company stationery, to Dept. PM-1, Light Metals Division, Thompson Products, Inc., 2269 Ashland Road, Cleveland 3, Ohio.

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LIGHT METALS DIVISION

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COVER STORY

THREE ENGINEERS at O. F. Mossberg & Sons, Inc., examine a new shotgun they manufacture, using investment cast components. Shown here are: l. to r., Harry Larson, design engineer; Carl Benson, chief design engineer; and Paul Jacobson, works manager. The story begins on page 38.

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JANUARY 1956 VOLUME 14 NUMBER 1

Precision Metal Molding

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36 **THE DIE CAST ENGINE BLOCK . . . AND WHAT AUTO MAKERS THINK OF IT.**

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SMALL

or

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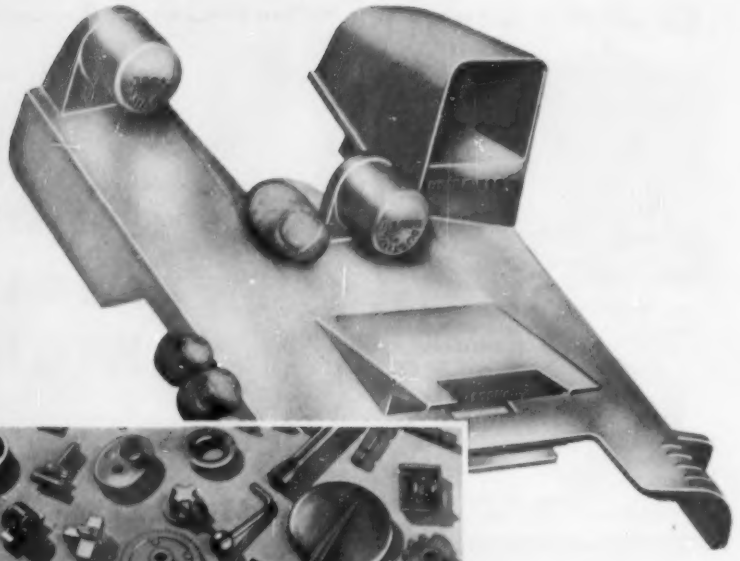

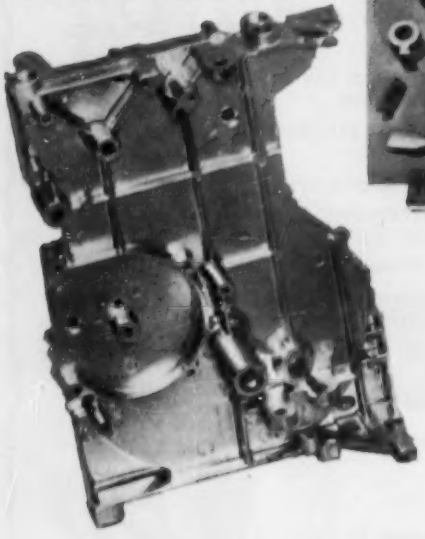

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Dollin engineers and die-makers have solved the most complex problems of design—developed unique and ingenious techniques that greatly increase production, cut costs and improve the die-casting.

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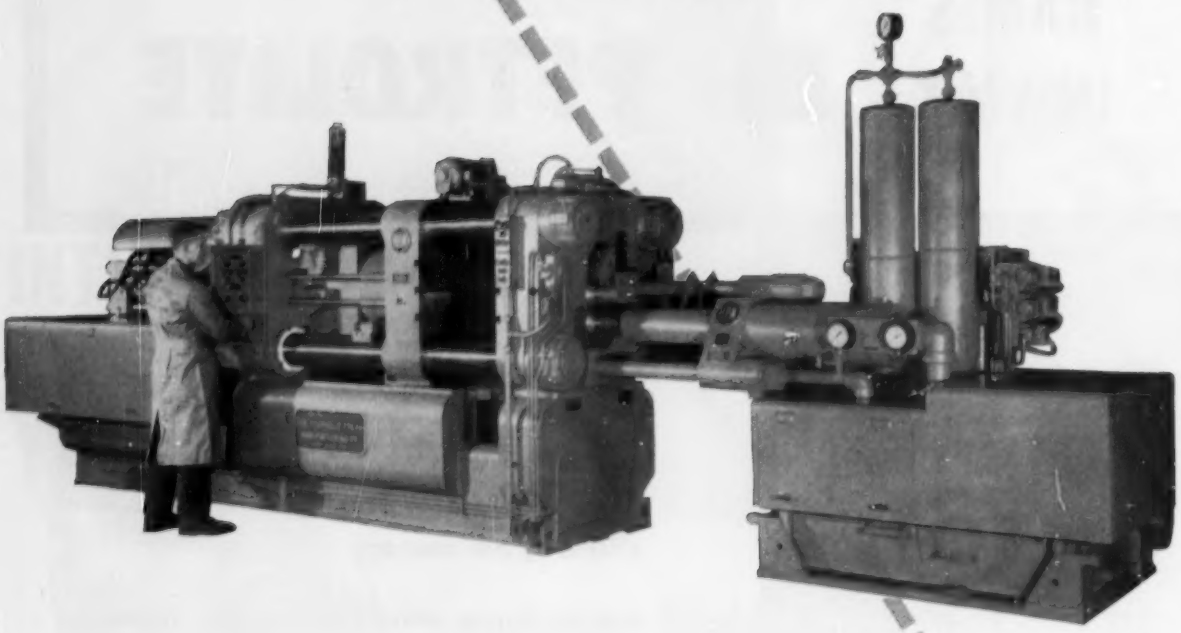

First Completely New Die Casting Machine In 15 Years

This new machine is the answer to many of today's die casting problems . . . cleaner castings . . . negligible scrap . . . better dimensional control with production output to meet any job requirement. It's time proved through four years of development with one year acceptance in the field.

H-P-M's all new hydraulic-mechanical link wedge clamp and new design injection end result in a brand new approach to die casting technique. Accurate closing of mold eliminates excessive flash. The new clamp has plenty of "beef"—clamp locks mold firmly to at least the rated tonnage and "beef" limits die parting on overload during metal injection. The new injection end has unlimited motion control . . . exceptionally high speed. Get the complete story on this new H-P-M before you buy. You'll be glad you did.

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THE HYDRAULIC PRESS MFG. CO.
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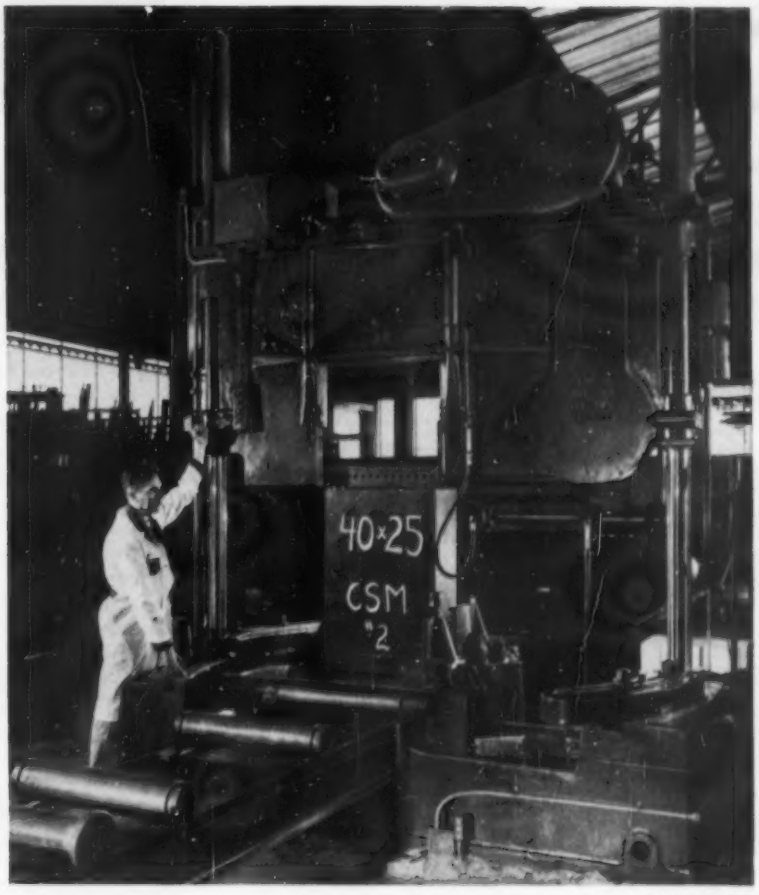

Photo by Hedrich-Blessing

Prompt delivery

of **DIE CASTING DIE STEELS** from warehouse stocks

...every piece ultrasonically inspected

Crucible warehouses from coast to coast stock over 460 sizes of CSM 2 and NU DIE V die casting die steels—1″ to 40″ wide—¾″ to 15″ thick! And they're all available for *prompt* delivery.

What's more Crucible warehouses are equipped to cut die steels to the size you want. The hacksaw pictured above in one of Crucible's warehouses, for example, is the largest made. It can accurately cut die blocks up to 40″ x 25″.

Huge stocks, plus versatile sawing and handling facilities, mean you get the steel you want *when you want it*. There's no need to wait for delivery from mill or forge shop when you can get *prompt* delivery from Crucible warehouse stock.

But there's more. Ultrasonic inspection of *every* piece of Crucible die casting die steel assures *sound die steel quality* every time. So next time you need die steels, look no further than your nearest Crucible warehouse. *Crucible Steel Company of America, The Oliver Building, Mellon Square, Pittsburgh 22, Pa.*

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BETWEEN THE LINES

DO YOU HARASS YOUR VENDOR to make a delivery of castings earlier than he originally agreed to ship them? There are sound reasons why he may not be able to step up the schedule to get you off the hook. If you can anticipate your productions needs far enough in advance, it will avoid a lot of problems and will assure you smoother operations. An outline of the steps in preparation from the time your jobbing die caster gets your blue prints, until he is ready to start production, begins on page 42. It may answer some of your questions if you are sweating out a shipment of castings.

THE SECOND STEP HAS BEEN TAKEN toward the practical development of a one piece, die cast aluminum engine block. The first step was announced more than a year ago with the introduction of a die casting machine large enough to handle a super-sized casting; now, the first experimental run of these engine block castings has been made. This is the second step. What comes next? Obviously, testing and cost study must precede the actual introduction of die cast engine blocks on a production basis. We have asked responsible engineers in some of the major automobile companies for their opinions on the prospect for these new engine blocks which would bring aluminum into the heart of the materials picture for tomorrow's cars. The comments appear on page 37.

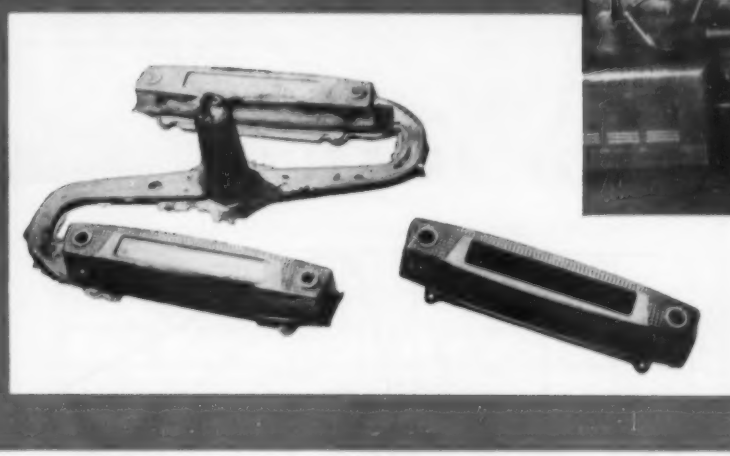
JUST AN "IN-BETWEEN" PROCESS? If you feel that permanent mold casting is only suitable for a limited range of jobs . . . those that have too high volume for sand casting but not enough to pay for die casting dies . . . you should look at he figures. Permanent mold casting has been showing a healthy increase during the past several years, and there are many important applications of this process. The unique metallurgical properties of permanent mold castings, along with the design freedom permitted, make it a preferred method where special properties are needed. A report on the prospects for permanent mold casting begins on page 48.

WHAT ARE THE CONSUMER-GOODS MANUFACTURERS LEARNING from the aircraft industry? One would think that manufacturers who sell to the public would long ago have learned all the tricks of speeding production, eliminating secondary operations and cutting costs. But the aircraft industry has been making good use of a fabricating method which the makers of consumer goods are only beginning to recognize . . . investment casting. An example of this is reported beginning on page 38, telling how investment castings have been introduced in the new models of a leading make of sporting gun.

SHOULD THE ALLOY LIST BE SHORTENED for use in die casting? This timely question, now being considered by ASTM, has prompted publication of a two-part article, beginning in the February issue of PMM, on the history of the present die casting alloys.

High plunger pressures assure extra-dense castings like these aluminum drill parts made on a 2G machine.

Nordon produces a wide variety of zinc and aluminum parts on its five Reed-Prentice die casting machines.



Zinc control panel housings have a porosity-free, "hardware" finish.

HOW NORDON GETS DENSE, HIGH-QUALITY DIE CASTINGS

Nordon Die Casting Co., Inc., of Maywood, Ill., specializes in dense castings and high-quality finishes. To get these results they use Reed-Prentice machines exclusively. They have found the higher pressures in Reed-Prentice equipment mean minimum finishing and lower unit costs.

Only Reed-Prentice gives you full locking tonnage on every shot, with positive die locking that eliminates "pressure back-off." This mechanical locking, plus high plunger pressure, is the answer to quality parts and higher production rates. To get full information, call your nearest Reed-Prentice Sales Engineer.

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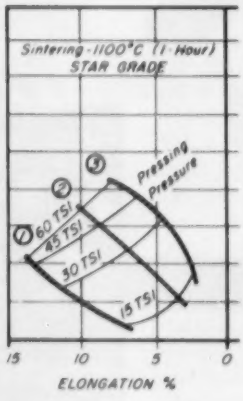
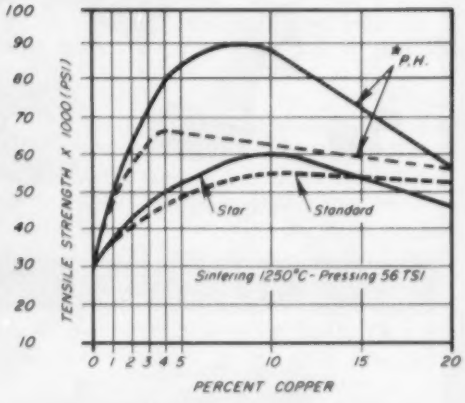
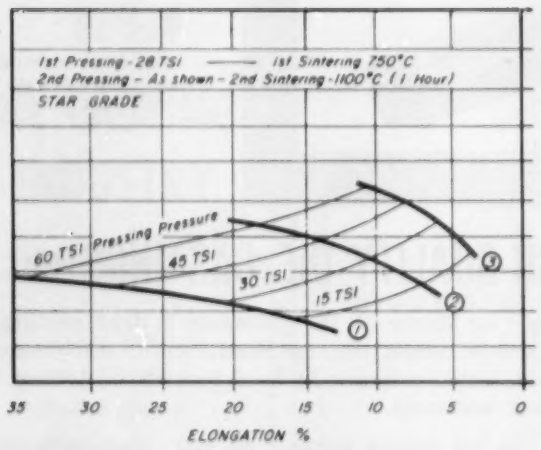




FOR DOUBLE PRESSING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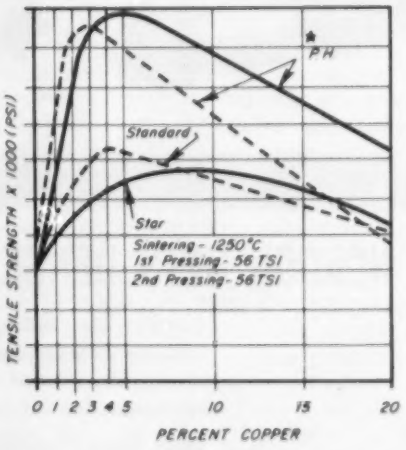
2nd Pressing - As shown - 2nd Sintering - 1100°C (1 Hour)
STAR GRADE
60 TSI Pressing Pressure
45 TSI
30 TSI
15 TSI
ELONGATION %



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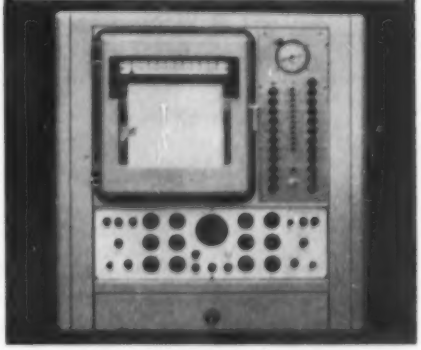

Close view of Quantometer Recording Console.

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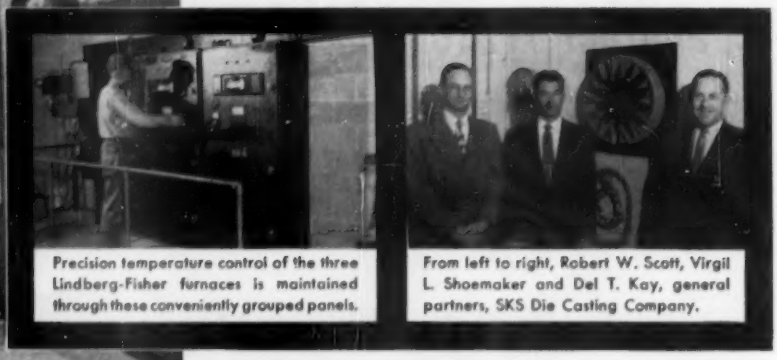

Precision temperature control of the three Lindberg-Fisher furnaces is maintained through these conveniently grouped panels.

From left to right, Robert W. Scott, Virgil L. Shoemaker and Del T. Kay, general partners, SKS Die Casting Company.

"Outstanding Improvement"

IN CASTING METHODS WITH LINDBERG-FISHER INDUCTION FURNACES

● SKS Die Casting Company, Berkeley, California, is engaged in critical close dimensional work in casting fuel cell fittings for aircraft. To achieve consistent results extremely close control of metal temperature is essential.

Mr. Del T. Kay, SKS general partner, says: "We had no previous experience in induction melting and holding and sought the best advice we could find. As a result, we have installed three Lindberg-Fisher two-chamber Induction Melting Furnaces. These fulfilled our requirements completely and represented an *outstanding improvement* over our previous methods."

Like SKS, you will also find that Lindberg-Fisher Induction Melting and Holding Furnaces provide these advantages: cleaner molten metal, continuous production, cooler operation and minimum maintenance. Ask us to recommend the proper type of furnace for your particular needs or write for our Bulletin 560.

LINDBERG-FISHER MELTING FURNACES

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UN-BREAKABLE
tempered and treated stainless steel die casting

PLUNGER RINGS

give up to

8 to 10 TIMES THE AVERAGE LIFE

of

Die Casting Plunger Rings

Name the largest die casters and you will have the users of Precision Un-Breakable Tempered and Treated Stainless Steel Die Casting Plunger Rings. The reasons are many . . . here are a few.

1. Precision Die Casting Rings are wrought, **not cast**, from dense, fine grain, flawless stainless steel.
2. They are formed to have uniform tension throughout the entire circumference.
3. They have flexibility and resiliency . . . yet withstand excessive temperatures without collapsing.
4. Special heat treatment processes give Rockwell C-48-55 hardness, yet . . . rings remain un-breakable.
5. Precision Rings are available specifically for die casting machines in various widths to suit your present and proposed plunger grooves.
6. They are engineered to let the ring take the load of sealing and maintaining pressure.

Precision's Engineering Department can solve your problems on die casting . . . increase machine productivity through longer ring life . . . reduce rejections and operating costs.

Write today for our recommendations on rings for your die casting plungers.

Precision

PISTON RINGS, INC.

Sales Offices: INDIANAPOLIS–CHICAGO–LOS ANGELES–SAN FRANCISCO–NEW YORK–PHILADELPHIA

Circle No. 61 on the Reader Service Card

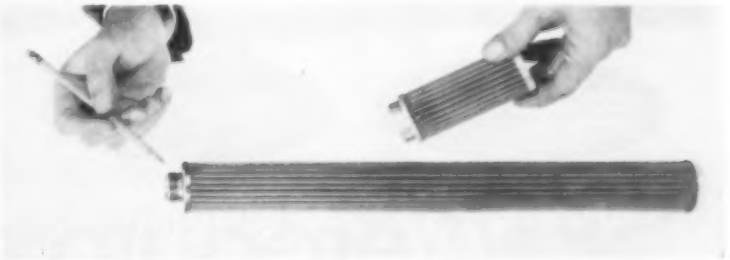
CASTING ABOUT

HIGHEST DAILY PRODUCTION of zinc was achieved during November, according to reports from the American Zinc Institute. Output reached a level of 2,894 tons of slab zinc per day during that period, a record production during a year in which zinc smelters have been consistently operating at the highest rate in history. By comparison, the average daily production of slab zinc during 1954 was 2,379 tons . . . much lower than the 2,723 which is the lowest daily output during any month in 1955 so far reported. Despite these record tonnages, stocks of zinc on hand at the end of November reached the lowest level in several years, dipping down to 38,021 tons.

SURFACE ROUGHNESS COMPARATOR introduced by Bausch & Lomb Optical Co. is housed in a rugged die cast case. This new production instrument helps in rapid examination of surface roughness in mass production operations. A standard roughness scale is inserted at the end of the instrument; the operator then holds the work to be examined up to the instrument and sees both surfaces in a circular field under 10 power magnification. An unusual illuminating system emphasizes surface irregularities under identical conditions to provide accurate comparison.

LOCOMOTIVES POWERED BY GAS TURBINES have become a feature of train service in the Pacific Northwest, now that Union Pacific Railroad has ordered an additional fifteen 8500 hp gas-turbine-electric locomotives from General Electric Co. Union Pacific, which has had 25 gas turbine-electric locomotives in service since early 1952, has plans for two additional blocks of 15 locomotives each. The 45 new locomotives, to be built at a cost in excess of 38-million dollars, will have a top speed of 65 mph, will weight 408 tons on 12 axles, and will be used to help U.P. in its program for handling its freight traffic load with maximum efficiency. According to the railroad company, "Union Pacific hauls freight faster than any other railroad in the world."

FILTERING AT 1000 F is one of the important features of new, sintered metal filters introduced last month by Purolator Products, Inc. The filters, made by powder metallurgy techniques from stainless steel, monel or other metals, as required, can remove particles as small as one micron from a wide range of fluids, including nitric acid, hydrochloric acid, strong alkalies, etc.



The filters, expected to find use in atomic, guided missile, aircraft, chemical, petroleum and food fields, were developed by Purolator in cooperation with Horizons, Inc. The one-piece sintered filter elements can be made in a variety of diameters and lengths.

Continued on next page

Use Aeroquip 1546 Hose with ANY Fire-Resistant Hydraulic Fluid

The use of fire-resistant hydraulic fluids around die casting machines and other plant "hot spots" increases safety and often earns lower fire insurance rates. And, regardless of the type of synthetic fluid you select, it can be conveyed with Aeroquip 1546 hose in high pressure systems without swelling or clogging. Aeroquip 1532 hose for medium pressure applications is also available.

A small inventory of Aeroquip bulk hose and reusable fittings can meet all your needs because replacement lines can be made by plant personnel, using ordinary hand tools. Installation takes only a fraction of the time needed to form and fit rigid tubing.

Check your Yellow Page Directory for your Aeroquip distributor, or write us for Bulletin 157.

Inner tube resists swelling and clogging when used with Pydraul F-9, Cellulube, and other synthetic hydraulic fluids.
Double wire braid construction takes working pressures up to 3000 p.s.i., depending on size.
1546
Tough, green synthetic rubber cover withstands heat, wear, abrasion.
1546 hose mates with standard Aeroquip industrial fittings.

Aeroquip

REG. TRADEMARK

AEROQUIP CORPORATION, JACKSON, MICHIGAN

LOCAL REPRESENTATIVES IN PRINCIPAL CITIES IN U. S. A. AND ABROAD
AEROQUIP PRODUCTS ARE FULLY PROTECTED BY PATENTS IN U. S. A. AND ABROAD

For more information circle No. 3 on the Reader Service Card

CASTING ABOUT
continued from page 13

MAGNESIUM POWDERS can be produced by a method recently patented by Dow Chemical Co. Molten magnesium is atomized into fine, spherical, uniform particles as it falls freely onto a rapidly rotating steel disc. Alloy constituents include small amounts of zirconium and large amounts of zinc.

THIRTY PERCENT INCREASE IN SALES this year is forecast for the investment casting industry by Vincent Lazzara, president of the Investment Casting Institute and president of Casting Engineers, Inc., of Chicago. Calling this a "conservative estimate," Lazzara points to the stepped up rate at which new orders have been received during recent months. Due to the development of new markets for investment castings, he says, 1956 sales by the industry may total 175-million dollars, a sharp contrast to total sales figures of 75-million dollars in 1948. According to the Institute's statistical department, 70 percent of the more than 100 firms now engaged in producing investment castings have entered this business since 1945.

NICKEL POWDER DIRECT FROM ORE is reported practical for the first time by a new chemical-metallurgical process developed by Sherritt-Gordon Mines, Ltd., Fort Saskatchewan, Alberta. Available in high and low density powders, wide use is foreseen for these fine nickel powders.

The high density powders have apparent densities of 3.3 to 4.3 gms/cc and have high purity, excellent flowability and good pressing properties, which make them suitable for alloying additions, electronics applications and such powder metallurgy techniques as direct rolling. Particle size can be varied from under 30 to over 200 microns.

The low density powders have properties similar to those of carbonyl nickel powders, with apparent densities of 0.3 to 2.0 gms/cc, with particle size concentrations in the 1 to 15 micron range and Fisher micron ranges of the order of 4.0. There has been interest in this powder for sintered plaques for the Ni-Cd battery, as well as for cermets and cemented carbides.

GUIDE FOR PHOSPHATING ferrous metals for surface protection

Continued on page 24

A NEW METALLURGICAL TOOL FOR THE PRODUCTION OF HIGH QUALITY CAST IRON*

We offer to the American industry the AJAX-JUNKER 60 cycle induction furnace for the melting and superheating of cast iron, and particularly for the production of ductile cast iron. The AJAX-JUNKER furnace is economical in foundries with intermittent operation and frequent alloy changes. It melts loose turnings with high recovery, and can easily operate at the high temperatures required for desulphurizing. Controlled stirring of the molten metal speeds up recarburizing rate and solution of alloy ingredients.

The photograph shows a Junker coreless induction furnace for melting and superheating cast iron in a German foundry.

For further information write to

AJAX ENGINEERING CORP., TRENTON 7, N. J.

AJAX

INDUCTION MELTING FURNACE

AJAX ELECTRO METALLURGICAL CORP., and Associated Companies
AJAX ELECTROTHERMIC CORP., Ajax Northrup High Frequency Induction Furnaces
AJAX ELECTRIC CO., The Ajax Hultgren Electric Salt Bath Furnace
AJAX ELECTRIC FURNACE CORP., Ajax Wyatt Induction Furnaces for Melting

For more information circle No. 4 on the Reader Service Card

to get any of the free materials described here, circle the appropriate number on the reader service cards bound into this issue

DATA OFFERED IN THIS MONTH'S ADS

2. DRY FILM LUBRICANTS that reduce rejects, increase mold life, and decrease lubricant consumption are described in Reprint DC and bulletin No. 425-Z10 from Acheson Colloids Co.

3. HYDRAULIC PRESSURE HOSE for use with any fire resistant hydraulic fluid is fully described in Bulletin 157, published by the Aeroquip Corp.

9. A TECHNICAL REPORT on aluminum and zinc die casting alloys has been published by the Apex Smelting Co. Properties, compositions, uses and other data are given.

11. GET MAXIMUM LIFE from plunger rings. In detailed literature that has recently been prepared, Auto-Diesel Piston Ring Co. give the performance of their rings and lists available sizes.

15. GREATER FLEXIBILITY in metal powder presses is claimed for the new units made by Baldwin-Lima-Hamilton. Two bulletins 3101 and 3104 fully describe and illustrate these machines.

16. SPECIAL ALLOY INGOTS for the investment casting industry are described and the chemistry, metallurgy and mechanical as-cast properties given in the latest MasterMet Alloy Bulletin from Cannon-Muskegon.

18. FULLY HYDRAULIC, smooth operating, positive locking; these are only a few of the features of the Model 400-N die casting machine described in literature available from The Cleveland Automatic Machine Co.

19. FOR EXECUTIVE AND ENGINEERING personnel, Cleveland Tool & Die Co. has prepared an extensive brochure that shows how tool and die costs can be lowered by having skilled men with the proper know-how make your tooling.

21. COMPLETE DATA FILE on stock and special die and mold components has been prepared by the Detroit Mold Engineering Co.

27. SPRAY MASKS that can be used on manual, semi-automatic or automatic finishing machines are described in a 20 page booklet from Wm. M. Fiore Co.

28. A NEW TECHNICAL MANUAL on shell molds, shell mold resins and the shell molding process is available from General Electric Co.

30. CONTROLLING WATER FLOW by means of a series of specially designed valves, interlocks and other devices is the subject of several technical reference folders from Hays Manufacturing Co.

31. ZINC & ALUMINUM FLUXES for more efficient dross separation are described in a bulletin from Haviland Products Co.

32. ENGINEERING DATA, technical information and recommended design and use material are in the new booklet on zinc base die casting alloys that has been prepared by Henning Bros. & Smith, Inc.

33. A 12 PAGE MANUAL covering cost, design, application and manufacture of investment castings has been prepared by the Hitchiner Mfg. Co.

34. "DIE CASTINGS", a file folder that shows how to step up production and cut costs, has been issued by The Hoover Co.

35. HEAVY DUTY DIE CASTING machines in a complete range from 200 to 1500 tons capacity are described and illustrated in a catalog from The Hydraulic Press Mfg. Co.

37. "CAST TO OUTLAST," a 16 page booklet on the investment casting process and the applications of investment castings to modern production is available from the International Nickel Co.

39. HIGH-DENSITY, HIGH-STRENGTH parts can be made from electrolytic iron powder. Full details are available from A. Johnson & Co.

42. A COMPLETE CATALOG of die casting machines, showing all models and any available special equipment can be secured from the Kux Machine Co.

44. IMPROVED MELTING METHODS helps to assure improved quality castings. Bulletin 560 from Lindberg Engineering Co. fully describes the latest developments in induction melting furnaces.

45. DESIGN INFORMATION to help in the proper and most economical application of aluminum and magnesium die castings has been prepared by Litemetal Dicast, Inc.

52. CUT DIE MAKING COSTS through the use of an Advance Cross-slide Rotary Table. How this tool can help in your die shop is told in specifications and literature from Morrison Engineering Co.

54. DESIGN AROUND STOCK-sized bushings and bearings to lower production costs. A complete listing of these stock sizes is available from National Molded Products Co.

55. DIES BY HOBBING can reduce tooling costs. How, when and why to hob is told in a booklet from Newark Die Hobbing & Casting Co.

57. CUT COSTS with plaster mold casting. A brochure from Ohio Precision Casting Co. gives a number of interesting case histories.

58. DIE-BUILDING SERVICE of Permanent Mold Die Co. is introduced in a brochure that shows how this company produces casting dies and molds to your specifications.

59. WAXES FOR INVESTMENT CASTING patterns to meet any regular or special requirements are described in literature from the Bareco Wax Co., Div., Petrolite Corp.

61. UNBREAKABLE PLUNGER RINGS for die casting machines, made from tempered and heat-treated stainless steel, give from 8 to 10 times the average life of conventional rings. Pertinent data and technical information sheets are available from Precision Piston Ring Co.

64. TECHNICAL INFORMATION and advice on the proper use of fluxes to improve melts and lower costs are available from the Rossborough Supply Co.

66. FURNACES AND AUXILIARY EQUIPMENT for every non-ferrous melting need are fully described in the all new Stroman Furnace & Engineering Co. catalog.

67. MULTIPLE SPINDLE MACHINE for automatically driving studs into die castings is described in a reprint that can be secured from Studrive, Inc.

Continued on page 20

for small die castings . . .

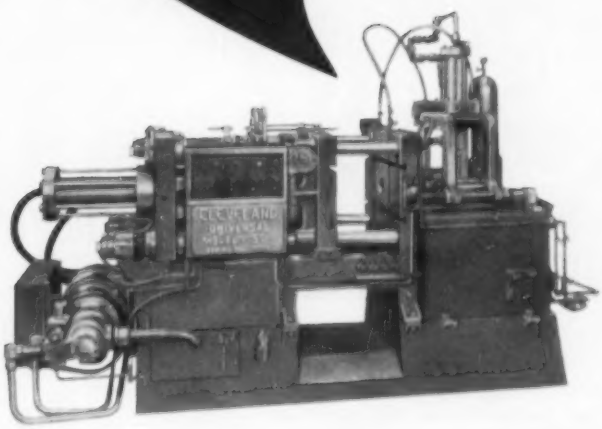
you'll get profitable production from this fast, efficient, low cost

CLEVELAND
Model 50

For small die cast parts, you can depend upon the Cleveland Model 50 Universal Hydraulic Die Casting Machine to give you *profitable* production — on high volume runs or short runs where the die investment can be low.

Very economically priced, the Cleveland Model 50 is designed and engineered to provide every essential to insure precision-quality castings at a high rate of speed. The Model 50 will free cycle at over 1000 times per hour. Tie bars, toggle links, pins, platens are of extra-heavy, rigid construction. Automatic electric timing of the cycle is a part of the standard control system. Hydraulic controls are provided for core pulls. High injection speed and pressures assure sound, dense, *"hardware"* finish castings.

Detailed information on these and many other Cleveland-quality features is given in Bulletin No. 50, which also describes the next size larger, Model 100, Cleveland Die Casting Machine. Write for your copy today. Better still, arrange now to discuss your die casting machine requirements with the Cleveland Automatic Sales Engineer in your area. There is no obligation.



Cleveland Model 50 Universal Hydraulic Die Casting Machine. Converts from zinc, tin or lead casting to aluminum, brass or magnesium casting by simply changing the hot-metal shot end. Size of die plates: 18¾" x 22". 50-tons locking pressure. Similar in construction to machine shown above is the Cleveland Model 100 Die Casting Machine which has 22½" x 24½" die plates, 100-tons locking pressure.

Write for Bulletin 50

THE CLEVELAND AUTOMATIC MACHINE COMPANY

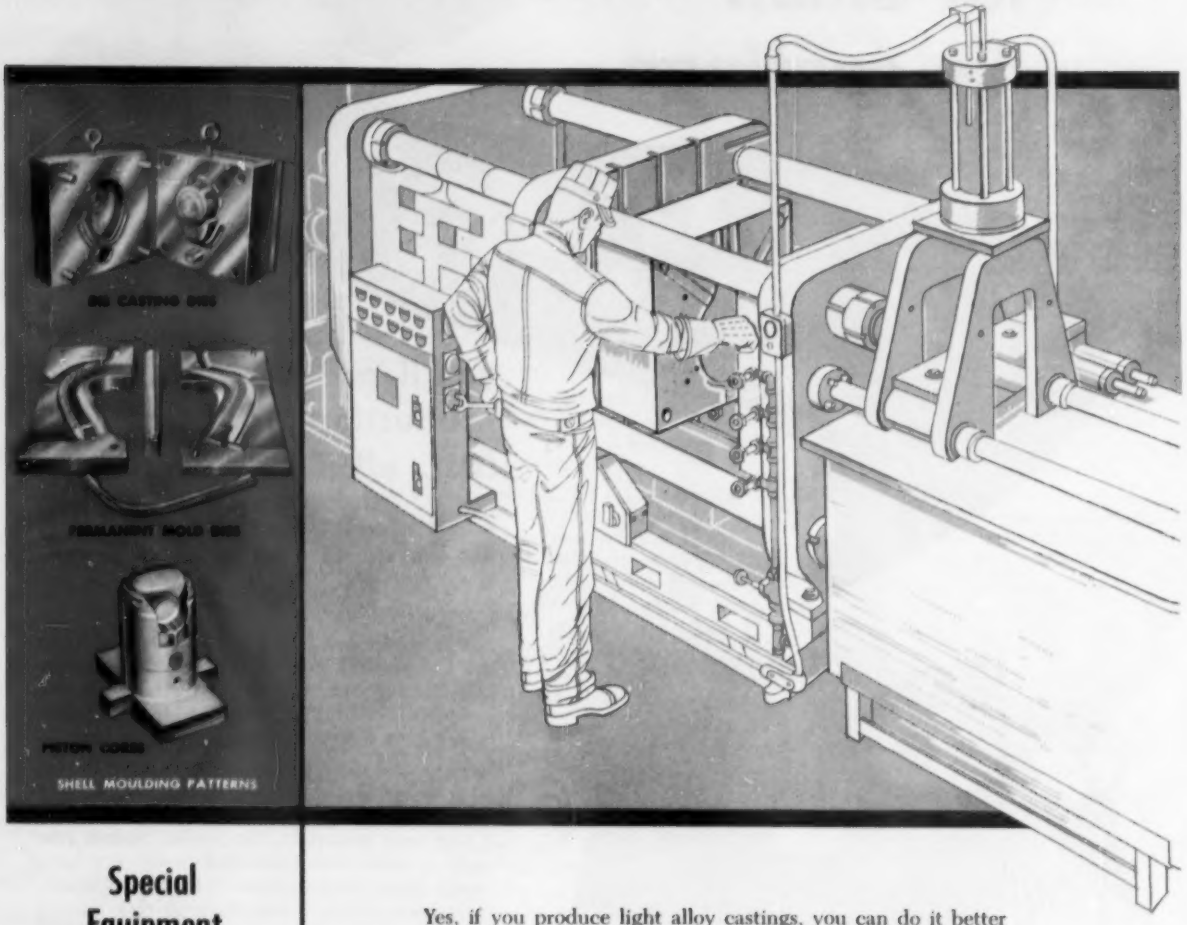
4952 Beech Street
Cincinnati 12, Ohio

SALES OFFICES: CHICAGO
CLEVELAND • DETROIT
HARTFORD • S. ORANGE

Manufacturers of a Complete Line of Single Spindle Automatic Screw Machines and High Pressure Hydraulic Die Casting Machines

For more information circle No. 18 on the Reader Service Card

if you can do it with light alloys . . .
you can do it BETTER with PMD dies!



Special Equipment

- Permanent Mold Operating Devices
- D.C. Casting Units
- Billet Molds
- Coilers for Tubing
- Trim Dies

COMPLETE DESIGN AND ENGINEERING SERVICE AVAILABLE

Yes, if you produce light alloy castings, you can do it better with PMD dies! Longer service life, minimum starting problems, lower overall tooling costs—these are plus advantages you get from PMD!

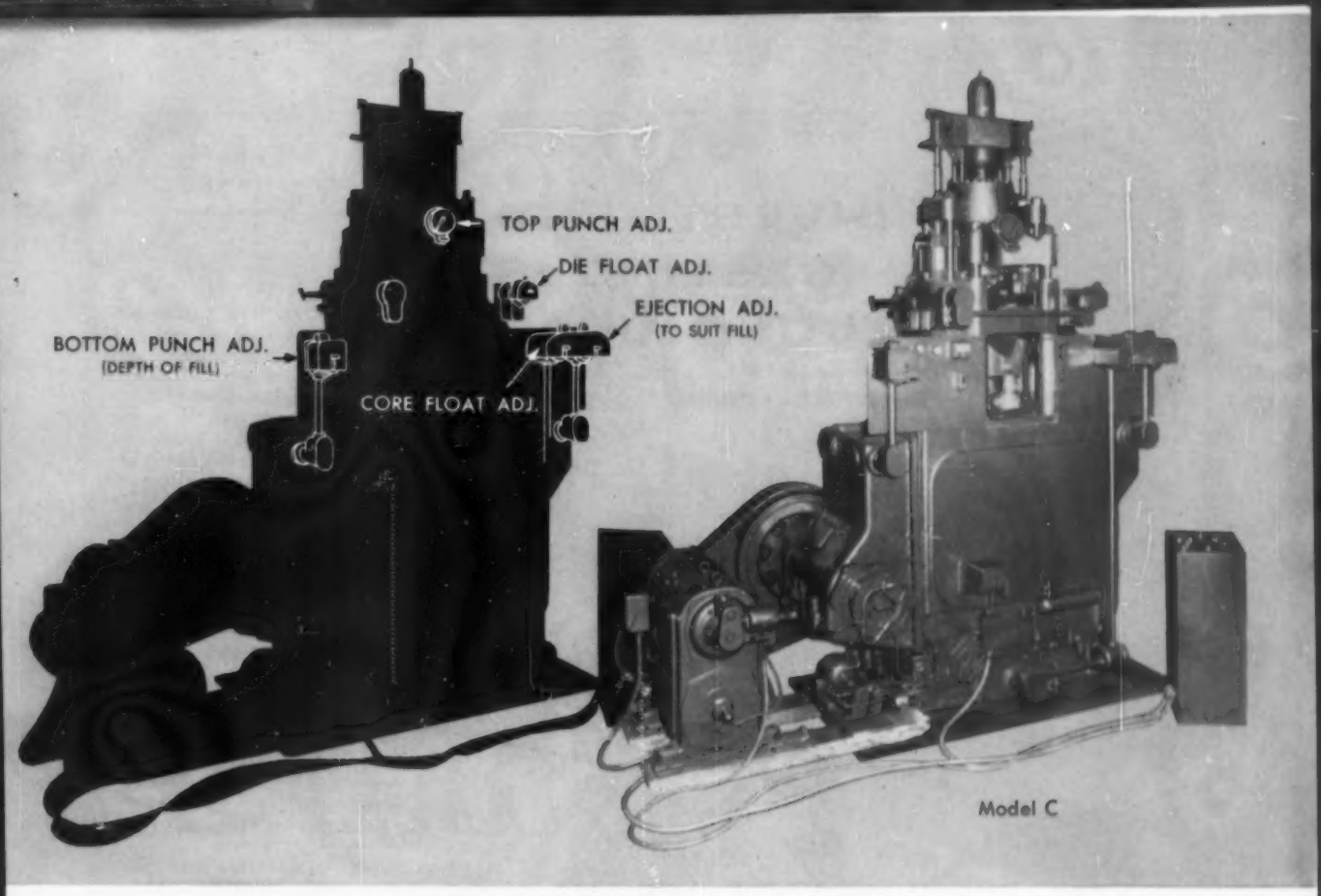
One of America's largest independent producers of dies, molds, special machines and molding devices, Permanent Mold Die Company offers every facility to do the job right! Complete design-engineering service . . . skilled, experienced personnel . . . plus the specialized tools and equipment to meet every requirement.

PMD dies and molds are *guaranteed* to perform to your specification! For the right solution to your tooling problems—call in a PMD specialist. Write or phone today!

PERMANENT MOLD DIE COMPANY, INC.
2273 East Nine Mile Road · Hazel Park, Michigan
Phone: SLocum 7-8100

WRITE TODAY FOR YOUR COPY OF THIS NEW PMD REFERENCE CATALOG!

For more information circle No. 58 on the Reader Service Card



INDIVIDUALIZED COMPONENTS of new Baldwin powdered metal presses make adjustments easy

It's mighty easy to make adjustments in density or weight in Baldwin's new Model "L" and "C" presses. That's just one of the results of a new concept of compacting powdered metals.

These revolutionary new Baldwin presses are not just remodeled heavy-duty pill presses. They have been designed expressly to meet your end product's needs. For example, instead of having combinations of actions, press components have been individualized. That enables you to make adjustments easily to fit any job.

Since there are no cams to change, many of the adjustments can be made while the presses are in operation. Also all controls are concentrated on one panel for easy supervision and adjustment. Two separate controls adjust the depth of fill and the stroke of the bottom punch. The relative position of the core rod to the die is also adjustable to aid in controlling the fill when making counterbored parts.

Further evidence of Baldwin's new concept includes such unique powder metal press features as . . . hydraulic heads, shuttle type feeders, independently floating die and core rod, automatic lubrication and variable cycling. It's no wonder that initial tests prove that these new Baldwin presses can out-produce competitive models by 200%, turn out compacts to closer tolerances and eliminate costly grinding operations.

You'll find more information and specifications on these new presses in our Bulletins 3101 (C) and 3104 (L). Write Dept. 4856, Baldwin-Lima-Hamilton Corporation, Philadelphia 42, Pennsylvania.

BALDWIN BLH LIMA-HAMILTON

Eddystone Division

BALDWIN-LIMA-HAMILTON

For more information circle No. 15 on the Reader Service Card

INVESTMENT CASTING IS ECONOMICAL IF...

- **Performance requirements demand use of alloys that are difficult to form or machine.**
- **Intricate shape or unusual contours cause expensive machining, finishing, and/or assembly costs.**
- **Production runs too small to warrant machine set-ups.**
- **Part sizes are smaller than 10" or lighter than 10 pounds.**
- **Realistic tolerances and inspection standards are specified.**

ARWOOD engineers will gladly help you with your design and production problems. They are casting specialists. Let them study your blueprints or a sample part and save you time, effort and money.

A CASE IN POINT!
LIGHTER, STRONGER, CHEAPER

Stainless steel hinge for military ordnance component was formerly composed of a stamped bracket and machined hinge, welded together and assembled to a complicated anti-rotation device. Entire unit is now cast in one piece and is lighter and stronger. Hole-reaming is only machining required.

Write TODAY for your FREE copy of "A Critical Survey of Investment Castings", written especially for design and production engineers.

ARWOOD

ARWOOD PRECISION CASTING CORPORATION

71 Washington Street • Brooklyn 1, New York

Plants: Brooklyn, N. Y. • Groton, Conn. • Tilton, N. H. • Los Angeles, Calif.

"PIONEERS IN INVESTMENT CASTING"

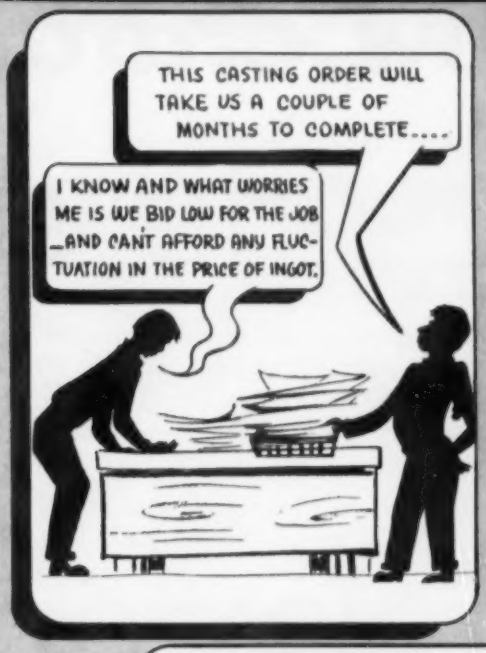
For more information circle No. 12 on the Reader Service Card

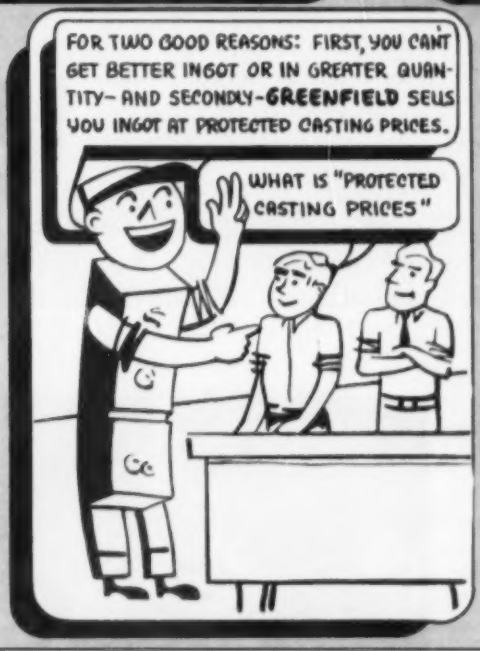
DATA IN ADS
continued from page 16

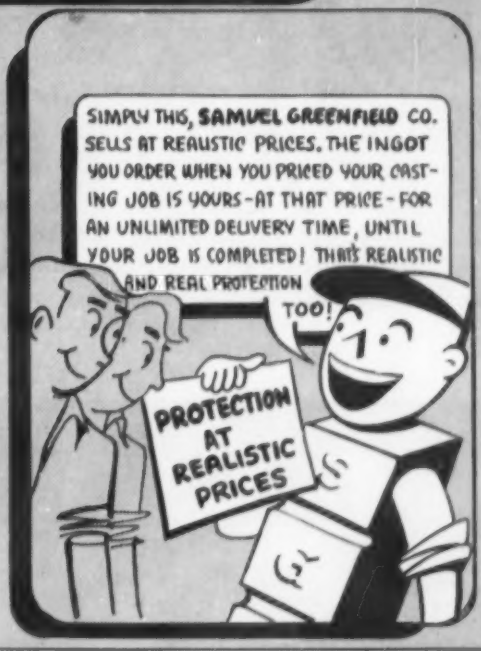
68. AMORPHOUS TYPE SILICA with low moisture content and controlled pH and in particle size ranges from 1 to 15 microns is described in a brochure from Tamms Industries, Inc.
69. "CREATIVE CASTINGS," a booklet prepared by the Light Metals Div. of Thompson Products, Inc. describes the engineering, design and production facilities available. Useful data on design and application are also given.
71. MEET THE ABBOT through the new brochure on barrel finishing and finishing materials that has been issued by the Abbott Ball Co.
72. LAB AND ENGINEERING REPORTS on finishes that block corrosion and still maintain high electrical conductivity are available from Allied Research Products, Inc.
73. COST-SAVING, TIME-SAVING methods of barrel finishing are discussed completely in a new 52 page catalog that has been prepared by Almco.
74. FULLY AUTOMATIC, ALL ELECTRIC lead screw tapping without reversing motors is described in bulletin A.T.U. from Ettco Tool Co., Inc.
75. BARREL FINISHING, 25% FASTER is the story of Grav-i-flo Corp. finishing machines and methods. A complete catalog of equipment and supplies is now available.
76. PREVENT THREAD SHEARING in soft materials through the use of self tapping threaded inserts. A descriptive folder on these inserts has been prepared by the Groov-Pin Corp.
77. FINISHING WITH ABRASIVE BELTS is an economical method. One machine can do grinding, polishing and deburring. A 20 page catalog describes this unit manufactured by Hammond Machinery Builders, Inc.
79. CLEANING METALS in the aircraft industry is the subject of a special report that has been prepared by Oakite Products, Inc.
80. HYDRO-FINISHING, a method developed by the Pangborn Corp. for super finishing of molds and dies, is fully described in bulletin No. 1403.
82. BETTER CHROMIUM PLATING is the subject of bulletins that have been prepared by the technical staff of the United Chromium Div., Metal & Thermit Corp.
83. TECHNICAL DATA, free samples and descriptive literature on the fluxes for zinc die casting alloys can be secured from Atlantic Chemicals & Metals Co.

SAMMY INGOT

PROTECTS YOUR PROFITS


THIS CASTING ORDER WILL TAKE US A COUPLE OF MONTHS TO COMPLETE....
I KNOW AND WHAT WORRIES ME IS WE BID LOW FOR THE JOB ...AND CAN'T AFFORD ANY FLUCTUATION IN THE PRICE OF INGOT.


FOR TWO GOOD REASONS: FIRST, YOU CAN'T GET BETTER INGOT OR IN GREATER QUANTITY- AND SECONDLY-GREENFIELD SELLS YOU INGOT AT PROTECTED CASTING PRICES.
WHAT IS "PROTECTED CASTING PRICES"


SIMPLY THIS, SAMUEL GREENFIELD CO. SELLS AT REALISTIC PRICES. THE INGOT YOU ORDER WHEN YOU PRICED YOUR CASTING JOB IS YOURS-AT THAT PRICE- FOR AN UNLIMITED DELIVERY TIME, UNTIL YOUR JOB IS COMPLETED! THAT'S REALISTIC AND REAL PROTECTION TOO!
PROTECTION AT REALISTIC PRICES

"OUR INGOTS MAKE BETTER CASTINGS"

SAMUEL GREENFIELD
ALUMINUM ALLOYS

- Chemically Pure
- Rigidly Supervised and Tested
- Certified Chemical Analysis Furnished

FREE FOUNDRY ENGINEERING CONSULTATION SERVICE

Over 120 years combined experience is yours at no obligation. Write or call . . .

SAMUEL GREENFIELD CO., INC.
HUmboldt 4050
31 Stone St. Buffalo 12, N. Y.

For more information circle No. 29 on the Reader Service Card

The world's largest opens a new era of

ABOUT one year ago, the largest die-casting machine in the world was completed and put into operation by Doehler-Jarvis Division of National Lead Company in cooperation with Kaiser Aluminum & Chemical Corporation.

Recently, the huge machine successfully produced the largest aluminum die-casting ever made—a six-cylinder in-line engine block weighing about 130 pounds less than a similar gray iron block.

The successful production of such a large and complex die-casting points the way to the design of large and economical die-cast aluminum parts for many industries.

Such parts would benefit from all the advantages of the die-casting process, which is inherently suited for mass production of parts requiring close dimensional tolerances, smooth surfaces, clean and sharp detail and thin metal sections.

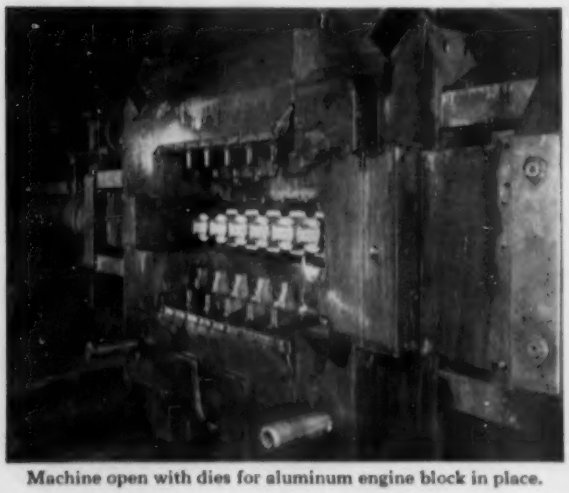
It is also possible to cast many details to size on the large press. In many cases, this eliminates the need to drill holes and other machining operations. Threads may often be cast to size, thus eliminating a threading operation. Cast-in metal inserts are readily included in die-castings.

Overall dimensional accuracy is another feature of die-castings that is important to many parts. This reduces the amount of finish allowance when parts are machined to a prescribed overall dimension.

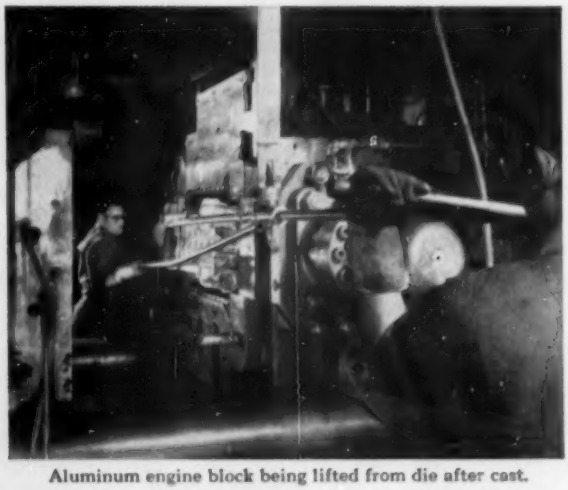
In addition, die-castings are generally lighter in weight than the equivalent parts made in sand or permanent mold, because thinner metal sections and less draft are permissible.

The metal quality of die-casting is more uniform than in a typical sand casting. Therefore, service life is more uniform.

Product designers and engineers should investigate this new Doehler-Jarvis Division of National Lead development in aluminum die-casting without delay to see if your existing or new designs can take advantage of the new 72" machine.

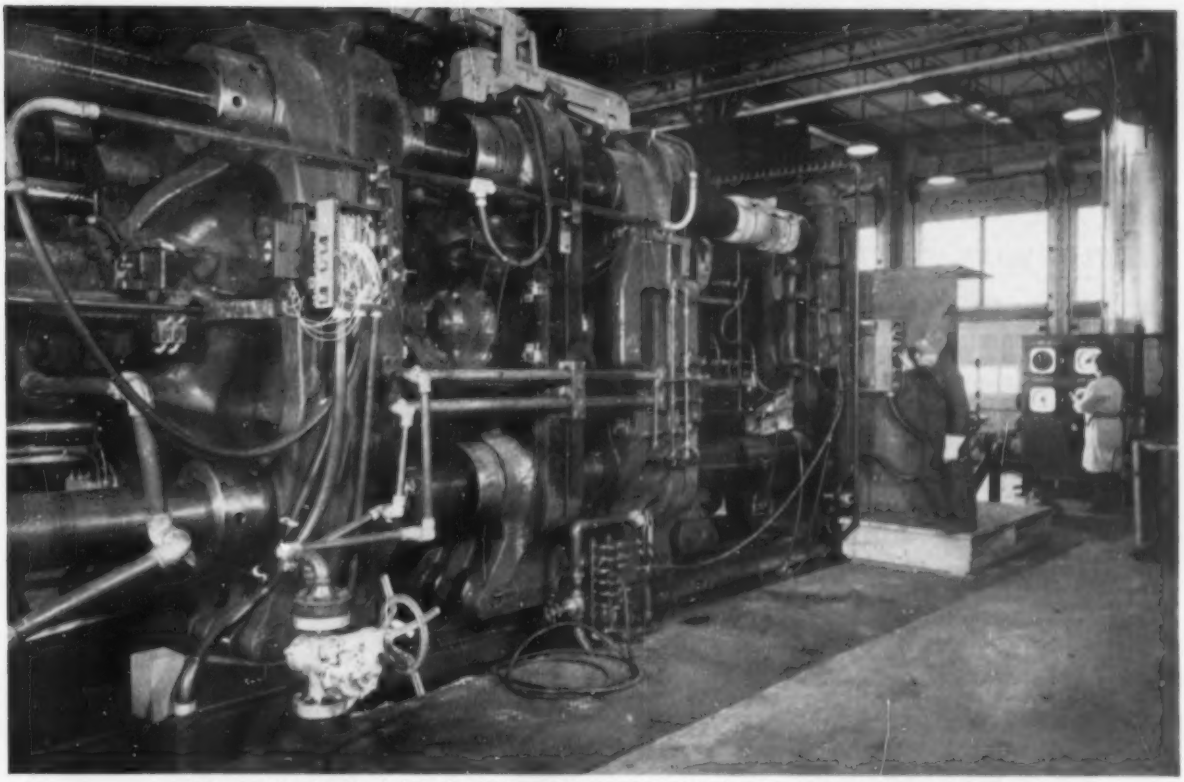


Machine open with dies for aluminum engine block in place.

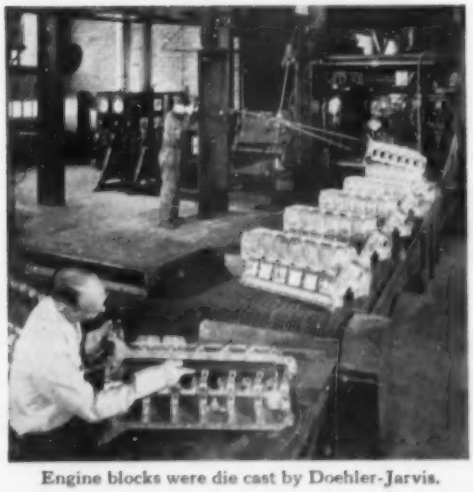


Aluminum engine block being lifted from die after cast.

die-casting machine product design!



The new Doehler-Jarvis 72" die-casting machine—the world's largest—located at Toledo Plant.



Engine blocks were die cast by Doehler-Jarvis.

If you need assistance with aluminum . . .

Let us work in partnership with you. We are eager to share our knowledge of aluminum and engineering skill. Development engineers will gladly provide engineering service and counsel on design and alloy selection which may give you a better product at a lower cost. Kaiser Aluminum & Chemical Sales, Inc., *General Sales Office*, Palmolive Bldg., Chicago 11, Illinois; *Executive Office*, Kaiser Bldg., Oakland 12, California; DETROIT OFFICE, *1414 Fisher Bldg., Detroit 2, Michigan, Phone Trinity 3-8000.*

Kaiser Aluminum

setting the pace—in growth, quality and service

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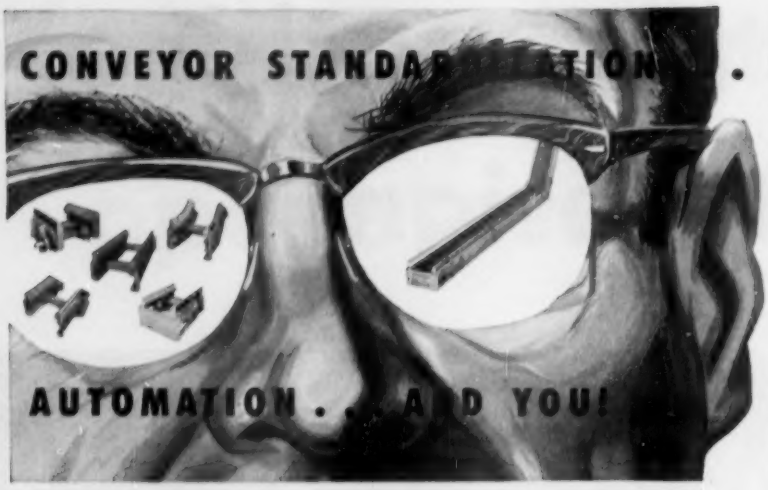

Now you can buy CUSTOMIZED conveyors in pre-fabricated STANDARD sections

In a single glance, you can see all of the advantages of MAY-FRAN STANDARDIZED components.

The five standard sections shown can be assembled to form virtually any type of *"customized"* conveyor for the handling of stampings, formed metal parts, forgings, automotive scrap, chips and turnings.

Straight sections . . . concave or convex sections . . . take-up charge and discharge-end sections can be furnished to meet specific requirements of belt width as well as load bearing and volume capacities.

A single glance at the MAY-FRAN conveyor standardization program, and you will see savings never before possible. In addition you will see unsurpassed conveyor flexibility.

MAY-FRAN . . . a name long recognized in the materials handling field . . . is **FIRST** again with *standardized* components for your *customized* installation.

MAY-FRAN

ENGINEERING, INC.

1686 Clarkstone Road
Cleveland 12, Ohio

Write today for complete information.

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CASTING ABOUT
continued from page 14

has been prepared by Rock Island Arsenal Laboratory and released by the Office of Technical Services, U.S. Department of Commerce. Methods, equipment and materials are covered in the 88-pg book, available for $2.25.

ALUMINUM DRY CELL BATTERIES with long shelf life have been developed by Aluminum Company of America. A variety of applications are being explored but the company says that the aluminum cell has not yet reached production stage.

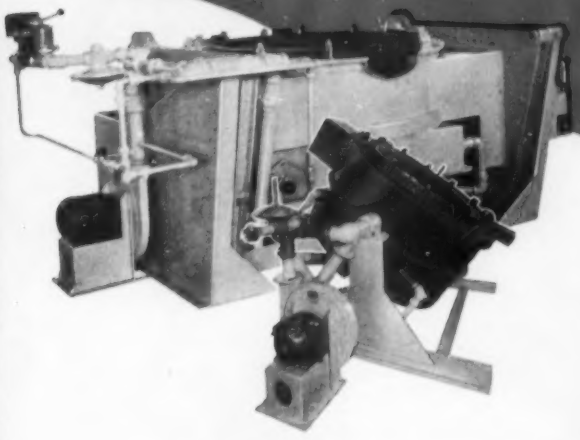
AIR-COOLED DIESELS produced by Kloeckner-Humboldt-Deutz A.G. of Germany were manufactured at the rate of 20,000 cylinder units per month during the first 10 months of last year, 65 percent ahead of 1954. The German concern produced 150,000 diesel engines over the past five years.

GOAL OF POWDER METALLURGY, according to Dr. Paul Schwartzkopf, president of American Electro Metal Corp., is to produce turbine buckets for jet engines and similar parts which retain high strength and oxidation resistance at higher temperatures than the presently-used super-alloys.

PRICE REDUCTIONS, the fourth in less than two years, were announced for titanium metal sponge by the Du Pont Company recently. According to Dr. J. B. Sutton of Du Pont, the price has been cut steadily from a high of $5.00 for top grade titanium, until it now sells for $3.75 per pound.

CONTINUOUS CAST BEARING BRONZE in 44 new, larger sizes (up to 9" diameter) have gone into production at American Smelting and Refining Company's Continuous-Cast Products Department. Representatives of the press recently had a preview of the patented process, which produces lengths up to 12'. Previously limited to a maximum 5" diameter due to the nature of the vertical casting units which imposed severe engineering limitations, the company now is in production on rods, tubes and shapes in the larger diameters, ready for machining or other fabricating processing. The Asarco process operates as a true gravity-feed bottom-flow casting method and is said to have these advantages: elimination of entrapped dirt or dross, freedom from gas porosity, freedom from sand, and has superior metal structure.

Get Perfect Pours at Lower Costs WITH Faster STROMAN FURNACES



Yes sir, you can bank on Stroman Foundry Equipment to deliver metal the way you want it, when you want it, everytime . . . for Stroman are the leaders in design of metal melting furnaces and equipment. For many years they have set the pace in the field, producing the finest furnaces that have effected tremendous economies for foundries, die caster, sand caster and permanent mold plants. They can do the same for you. Get full information . . . write for NEW Bulletin 900 today!

STROMAN TYPE "NL" FURNACES

For Aluminum, Zinc, Lead, Kirksite and other Soft Metals.

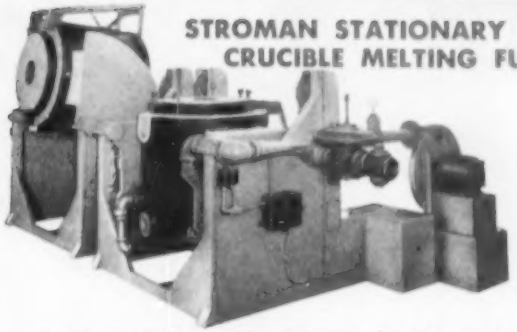
These furnaces have many uses and are particularly efficient when large pieces of metal or bulky scrap is to be remelted. The iron pots have a large diameter and a comparatively shallow bath. Available in choice of Hand Tilt or Hydraulic Tilt with Stationary Lip Pour.

STROMAN LARGE SIZE REVERBERATORY FURNACES

For melting unlimited capacities of Aluminum, Zinc or Brass.

Excellent for Smelting, Extrusion Work, Die Casting, Permanent Mold and Foundry Melting. Built to meet your particular melting problem. Now in use in many of the largest manufacturers of castings.

STROMAN STATIONARY LIP POUR CRUCIBLE MELTING FURNACE



For Brass, Bronze, Aluminum and other non-ferrous metals. Capacities from No. 60 to No. 1000 Crucible.

These furnaces with Stationary Lip Pour that assures a constant pouring arc meet specific needs in handling various metals for the foundry, permanent mold, die casting plants and rolling mill. It is ideal for use with monorail or dolly ladle for large quantities of metal. Eliminates spillage and waste.

STROMAN CRUCIBLE STATIONARY MELTING FURNACES

For Brass, Bronze, Aluminum and other non-ferrous metals. Sturdy, efficient and featuring the Stroman Push-Back Cover these stationary furnaces are designed for peak production and greatest fuel economy. Oil or Gas Fire. Capacities from No. 20 to No. 400 crucible.

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For ordinary or extremely high temperatures. A type built for every purpose.

• Centrifugal Blowers

Precision fabricated to deliver combustion air in any desired pressure or volume.

• Oil Pumping Units

Come complete, ready to hook into your heating system. Fool proof in operation.

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Selling Points Galore!

and the *telling touch* is

MADISON-KIPP

zinc and aluminum die castings

To finalize the sale of competitive "counter goods" quickly requires pre-planning and good judgment on the part of the product designer.

The skilled and experienced craftsmen at Madison-Kipp can often assist in providing the "telling touch" that might otherwise be missed.

Please clip this ad as a reminder to contact us when you have die casting requirements.

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• Skilled in Die Casting Mechanics • Experienced in Lubrication Engineering • Originators of Really High Speed Air Tools

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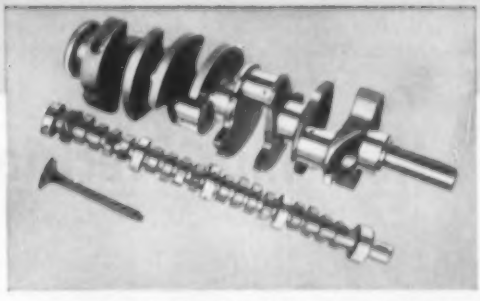
SHELL RESINS...
used extensively at FORD



Parts by the million for '56 Fords are

PRECISION-MOLDED with G-E SHELL RESINS

Ford Motor Company, one of the country's biggest precision molders, uses shell resins for precision-molded crankshafts, camshafts, exhaust valves.

Why did Ford turn to precision molding? Because of the advantages this method offers over conventional sand-casting: greater dimensional accuracy, smoother surface finish, drastic reductions in machining! And the Ford foundry uses G-E shell resins for fast-curing, dimensionally stable shells necessary for high-volume production.

How can shell molding help YOU?

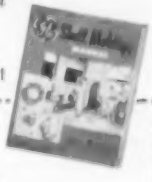
General Electric offers a number of foundry products to help *you* get maximum benefits from the new process: *G-E phenolic shell-molding resins* to form light, dimensionally accurate molds . . . *G-E silicone parting agents* to secure quick, easy release of molds from patterns . . . *G-E phenolic bonding resin* to cement shell halves together.

Progress Is Our Most Important Product

GENERAL ELECTRIC

Ask G. E. about shell molding!

General Electric maintains a shell-molding laboratory in Pittsfield, Mass., to help users and prospective users of shell molding solve problems and evaluate the process for their own needs. G.E. also offers an informative 28-page manual describing the techniques and benefits of this new foundry method. *Just mail the coupon for a free copy!*



FREE SHELL MOLDING MANUAL!

General Electric Company
Section 6-F1C1
Chemical and Metallurgical Division
Pittsfield, Massachusetts

Please send me a free copy of *G-E Shell Molding Manual.*

( ) We are presently using the shell-molding process.
( ) We are interested in the shell-molding process.

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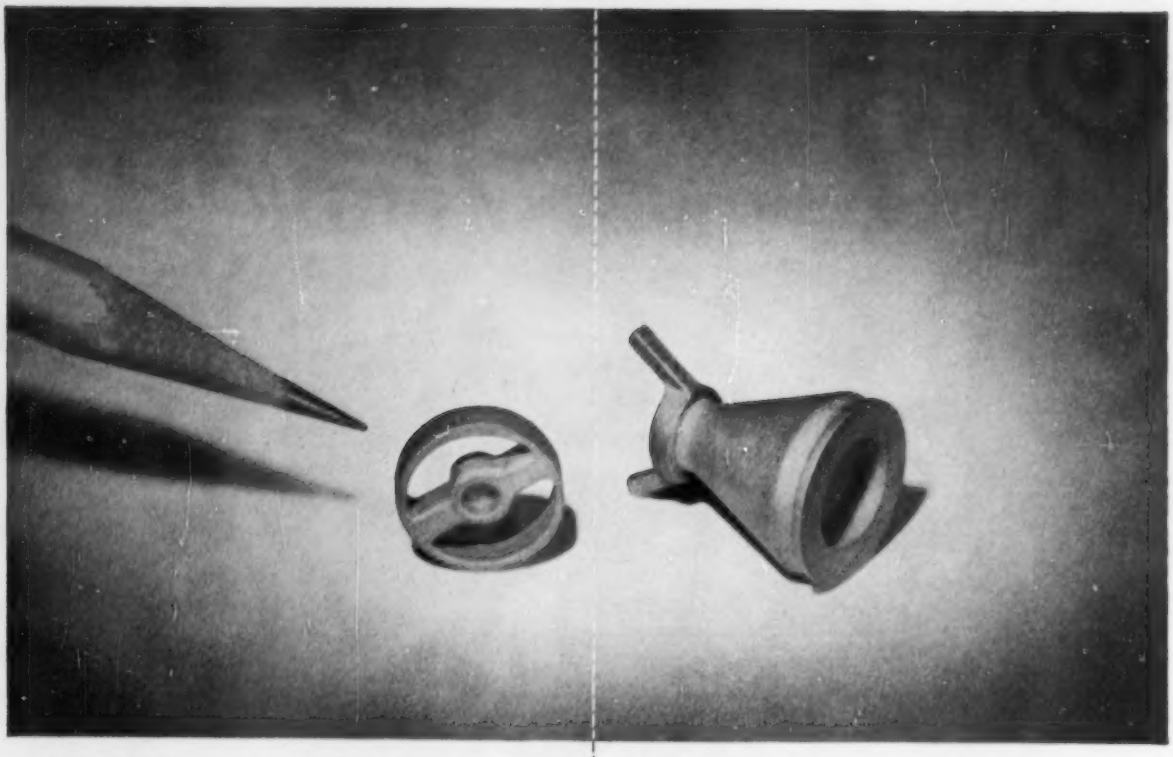

30% Saving American Machine and Metals, Inc., of Sellersville, Pa., manufactures the AutoBAR liquor dispensing system. This collet head is part of the locking mechanism.

15% Saving This collet spreader is used to lock the assembly in the neck of the bottle. Both parts shown above are twice life-size.

How Inco Precision Casting Cuts Costs

Look at these two small parts. Important to the AutoBAR liquor dispensing system, they are precision investment cast. But this wasn't always so —

When the collet head was machined from Inconel* nickel-chromium alloy bar stock it required ten costly operations—and about half the bar was machined away as scrap. Now Inco precision cast, it needs only lapping and drilling of one hole—cutting cost 30%!

And the collet spreader, when machined from bar stock, required three parts which had to be brazed together. It is now precision cast in one piece requiring only drilling and lapping one hole — cost is cut 15%.

On both parts a tolerance of plus or minus .003 inch per linear inch was held! Unusually close tolerances like this often can be held on small parts by Inco precision casting specialists.

All metal parts that come in contact with the liquor are made of Inconel nickel-chromium alloy or "K"* Monel age-hardenable nickel-copper alloy to protect color and flavor.

Can You Cut Costs with Inco Precision Castings?

Whenever you have a part which is 6 inches x 5 inches or smaller, weighs under 3 lbs., requires starting tolerances as close as plus or minus .005 inch per linear inch, and needs 5 or more fabrication steps, there's a good chance you can save by having it precision cast.

* * *

What Alloys Can Be Precision Cast?

You may obtain precision castings from Inco in many metals and alloys from plain carbon steel to the new super alloys. And no matter what metal you specify, you get many advantages.

*Registered Trademark

5 Advantages of Inco Precision Castings

- Save up to 60% of production costs.
- Longer life with harder alloys.
- Little or no machining required.
- Wider design latitude.
- Higher alloys at lower cost.

Get This Helpful New Booklet

Trying to keep costs in line on some small part? Then write for new 16-page booklet, "Cast to Outlast." Contains many case histories detailing how others cut costs with Inco precision castings. There is a good chance this helpful data will suggest a practical way to cut your costs, too.

The INTERNATIONAL NICKEL COMPANY, Inc.
67 Wall Street New York 5, N. Y.

INCO Nickel Alloys

Inco Castings . . . Precision, Sand, Centrifugal

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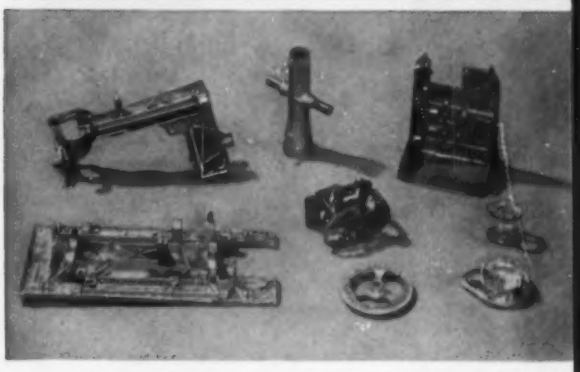
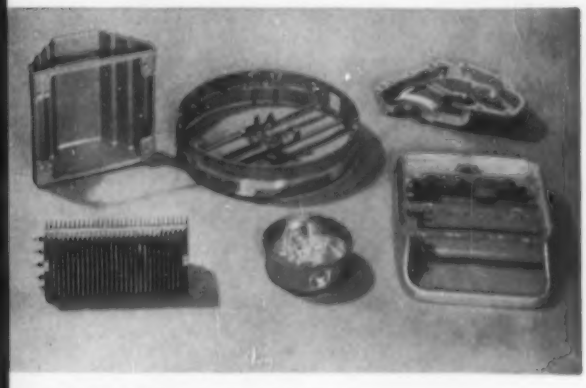
You Can LOWER COSTS with PRECISION DIE CASTINGS



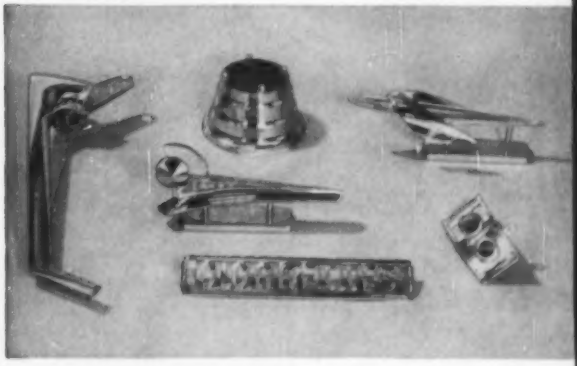
COMBINE PARTS INTO ONE DIE CASTING

Substantial savings in production costs can often be realized by combining several parts into one Precision die casting. You save not only on the cost of the parts but also assembly costs are eliminated.



REDESIGN PARTS FOR MORE ECONOMY

Parts formerly produced by other methods can be redesigned for low-cost die casting. Even present die castings may be redesigned for more economical production.



FINISHING COSTS ARE LOW

Precision die castings can be painted, oxidized, plated or self-finished by polishing. Precision has complete facilities for finishing die castings.

DIE CASTINGS FOR FUNCTIONAL PARTS

More and more functional parts are now being die cast at great savings. Today's modern alloys plus Precision's design and engineering skills combine to produce rigid, strong, accurate functional die castings.

Call a PRECISION Engineer, Today!

*Since 1909 the name "PRECISION" has been the symbol of highest quality in the die casting industry

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British Affiliation — Wolverhampton Die Casting Co., Wolverhampton, England

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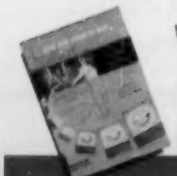
1
2
3
Recessed lettering on this oven control (1) requires raised letters in the cavity. Yet, from one master hob (2), you get multiple molds or dies with raised lettering (3), in any quantity, with a minimum of machining, filing and polishing.

Raised Lettering in Your Molds... Easy and Economical with

NEWARK DIE HOBBED CAVITIES

For lower tool costs and faster production . . . especially with multiple molds of complicated design . . . die hobbing is the method to choose. Because every cavity is cold pressed in steel from the same master, lettering and design details are always uniform. The high hobbing pressures (up to 100 tons per sq. in.) also cause the steel to flow and condense alternately, resulting in a closer surface grain structure. This provides an exceptionally long lasting luster . . . insures maximum fidelity of reproduction in the final product.



WRITE for your free copy of "How and When to Hob." Or let us discuss directly how Newark's complete die hobbing facilities and experience with all sizes and types of cavities may benefit you. No obligation, of course.

NEWARK DIE HOBBING AND CASTING CO.

30 SCOTT STREET, NEWARK 2, N. J. PHONE MArket 2-3306

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A review of recent U.S. PATENTS

A METHOD OF INCREASING THE SIZE of metal powder particles which comprises sintering the fine powder to an oxide with attendant particle size enlargement. The larger particles of oxide are then ground to the desired size, the oxide reduced to metal and the agglomerate formed during reduction broken up.

(Patent No. 2,721,135—Method of Producing Metallic Powders—Joseph J. Wimberly—assigned to the Tennessee Corp.—issued October 18, 1955).

A DIE CASTING SPEED CONTROL mechanism consisting of a hydraulic cylinder with end ports and an intermediate port. A reservoir for hydraulic fluid is connected to one of the end ports and a by-pass arranged between the reservoir and the other two ports. Valving is arranged so that speed of oil flow can be controlled by allowing liquid to flow through the by-pass lines.

(Patent No. 2,720,946—Speed Control of Actuating Element in Die Casting and Injection Moulding Machines—Stanley Smith—assigned to E.M.B. Co., Ltd., England—issued October 18, 1955).

A PROCESS OF MAKING IRON POWDER suitable for sintering, from blast furnace dust. The dust which contains approximately 50% iron is treated magnetically to separate about 10% of clean iron and clean iron oxide particles having a grain size of less than 0.5mm. The material so separated is then given a reduction treatment.

(Patent No. 2,721,134—Hubert Hoff, Wilhelm vor dem Esche and Heinz Lessing—assigned to Westfalenhutte Dortmund Aktiengesellschaft—issued October 18, 1955).

A DEW-POINT MEASURING apparatus consisting of an element on which a dew can be formed by changing the element temperature. A photo-electric cell interconnected with the temperature varying device on the dew element so that a constant amount of dew is maintained on the element; and a temperature measuring device of the potentiometer type.

(Patent No. 2,702,107—Dew-Point Hygrometer—Henry C. McBrair—assigned to Wallace & Tiernan, Inc.—issued October 11, 1955).

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Want more casting value per dollar?

Monarch pioneers in casting progress. Our casting and finishing facilities, unique in the industry, produce unusual casting performance. The job your casting must perform is economically accomplished with jobs we perform on the casting.

Illustrated are a few major industries capitalizing on Monarch's ability to guarantee top-value castings at factual, low end-cost.

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MONARCH ALUMINUM MFG. COMPANY
9205 Detroit Avenue, Cleveland 2, Ohio

PRESSURE CASTINGS subscribes wholeheartedly to the Certified Zinc Alloy Plan. We consider it good business to do so.

The Certified Zinc Alloy Plan requires the periodic submission of die castings to an approved and unbiased testing laboratory for the purpose of determining if their chemical composition meets strict ASTM specifications.

In addition, field representatives periodically visit member plants to select additional samples in production for test purposes.

Each sample casting must test "on grade" for the producer to retain his license and the right to use the Quality Certification Seal.

Every one using zinc die castings in their production should insist on CERTIFIED ZINC die castings.

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For more information circle No. 62 on the Reader Service Card

THEY'RE ANODIZING DIE CASTINGS

We have read in your November issue of Precision Metal Molding your article on "How to Colour Anodize Aluminium." It appears from your article that Pressure Die Castings of suitable Alloys is rarely attempted in your country.

We would like to inform you that we are regularly producing Pressure Castings in Aluminium Alloy capable of being Silver or Colour Anodized. If you would care to see samples, or any of your Readers, including the Writer of the article would like to contact us with regards to specific applications of the process, we shall be most pleased to advise.—A. H. (England)

The editors of PMM will be glad to put any of our readers in touch with this British commercial die caster. In the meantime, we hope to be able to present PMM's readers with a detailed article on this subject, since the color anodizing of aluminum promises to extend the range of applications for aluminum die castings.—Ed.

GLASCAST DATA

We are very much interested in receiving technical information and cost figures on the Corning Glass Works 96% silica glass casting process as outlined in the November 1955 issue of Precision Metal Molding.

We would also be very much interested in knowing what would be the largest size casting capable of being cast by this method and whether dimensions off the parting line can be held reasonably well, inasmuch as the parts are cast in a shell.—I. L.

Technical data beyond that contained in PMM's article have been referred to Corning Glass Works where development work is being carried out. Dr. Nicholas Grant of M. I. T. has done a great deal of research on this process for Corning, and reported on it recently before the Investment Casting Institute.—Ed.

Continued on page 67

IT MAKES ALL THE DIFFERENCE IN THE WORLD

EpCo VACUUM CASTING

A New Technique for Increased QUALITY CONTROL

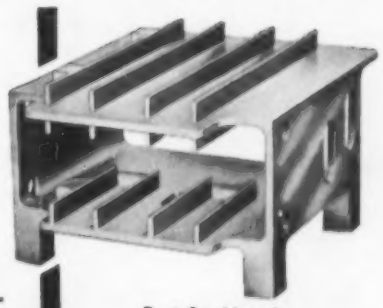
An EPCO development, Vacuum Investment Casting can give your parts and assemblies qualities no other casting process can match.

It is now being used on aluminum, bronze and steel and imparts these qualities.

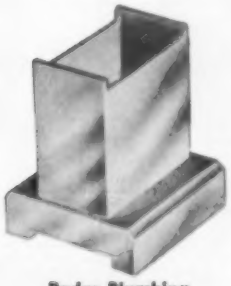
1. **Improves physical properties.**
2. **Improves surface finish.**
3. **Produces pressure tightness comparable to bar stock and forgings in aluminum and copper-base alloys.**
4. **Permits greater use of poor castable materials such as magnetic iron, pure copper, invar and radar plumbing materials such as aluminum 2S and 61S which are used for their better weldability.**
5. **Permits design of sharper corners, thinner sections than previously possible even with centrifugal casting.**

In EPCO's new Vacuum Casting process may lie opportunities for further improving parts now cast, and equally important for casting parts and assemblies never before considered possible.

Investigate the savings in production costs and improvement in quality and design by getting an EPCO quotation before machining or assembling your intricate parts.



Part for Aircraft
Aluminum 356-T6



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Aluminum 61-S

Solenoid Housing
Magnetic Iron

Specify EPCO for your assurance of better quality.

EpCo ENGINEERED PRECISION CASTING CO.

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and others...

Such patronage must be deserved

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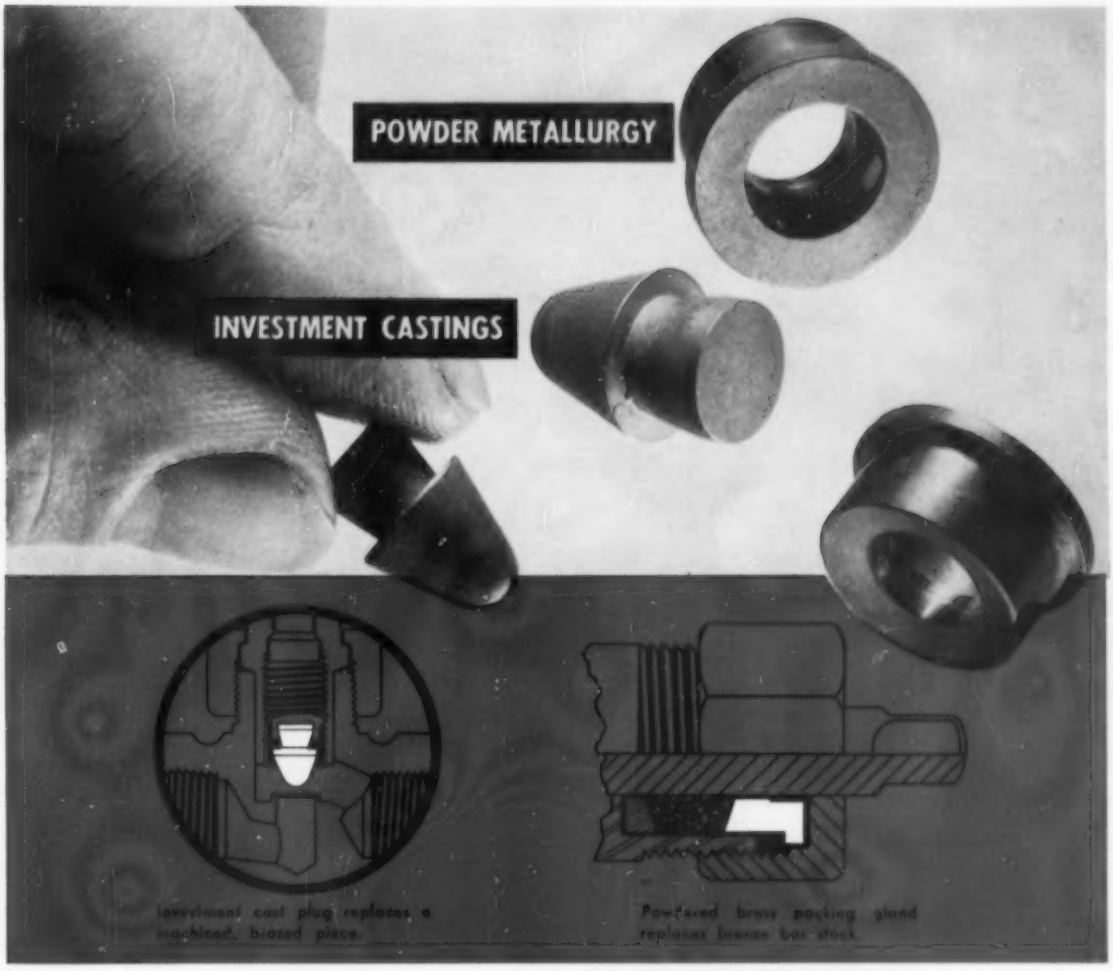

POWDER METALLURGY
INVESTMENT CASTINGS
Investment cast plug replaces a machined, brazed piece.
Powdered brass packing gland replaces bronze bar stock.

Precision Wear-Parts For Valves

IN the type 440 valve manufactured by Kerotest Mfg. Co., two small parts made from brass powder are now used instead of parts which were formerly machined from bar stock. The change has resulted in parts with superior wearing properties at a lower cost.

Cut-away sketch of the valve, above right, shows where the brass parts are used as glands above and below the packing.

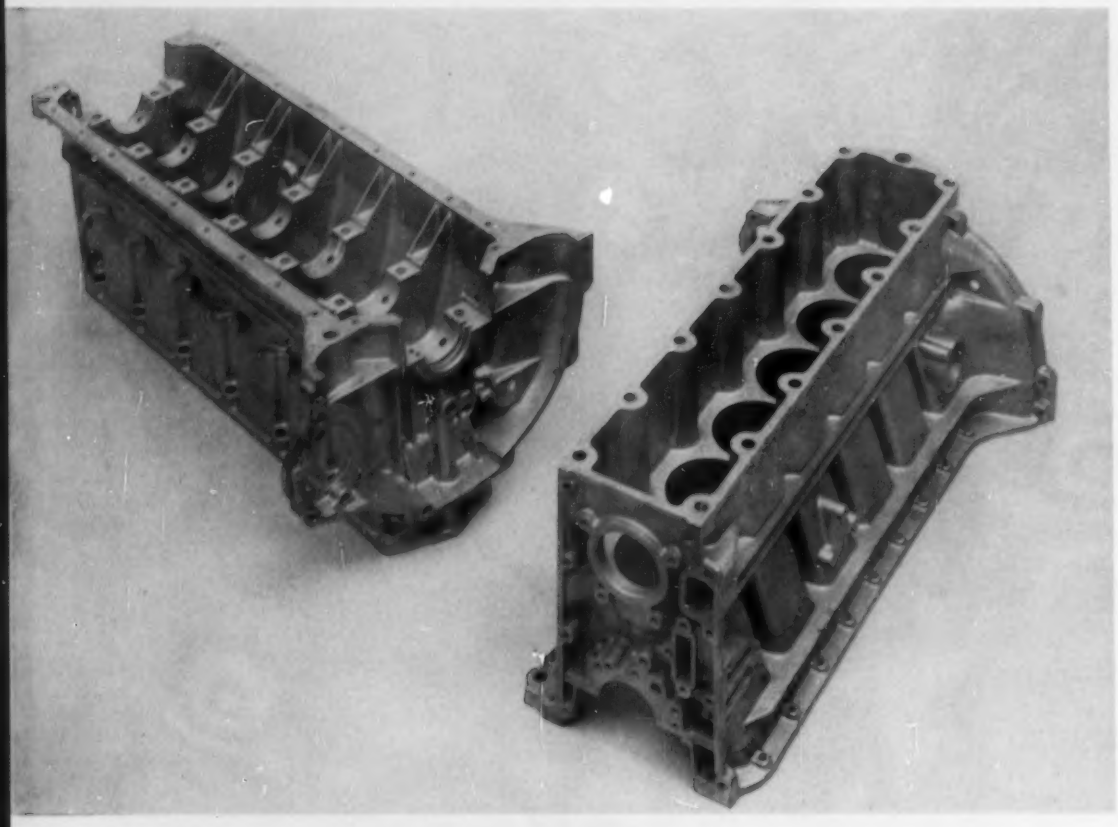
As the valve was originally designed, these glands were machined from bearing bronze bar stock. Scrap losses were, of course, quite high and the required duplication of dimensions from piece to piece was rather difficult to maintain.

Replacement of the machined bronze part with one made from brass powder by the Powder Metal Products Co. of St. Marys, Pa., has resulted in materially lowered piece costs, uniformity of dimensions from piece to piece and strict adherence to dimensional tolerances. Since the part is somewhat porous, it picks up oil and thus has superior lubricating properties around the valve stem than were previously secured.

A still further advantage of the powdered brass parts is the superior finish and absence of tool marks. Since the glands are used as received from the fabricator, inventory problems are simplified, inspection loads reduced and assembly simplified.

PLUGS for the type C77 and N205 valves manufactured by the Kerotest Mfg. Co. were originally designed to be made of Stellite. During the early stages of

Continued on page 56



Straight six engine blocks are coming off the production line at a rate of 30 to 35 per hour. They weigh 50 pounds as cast and have 129 holes cored to size.

The Die Cast Engine Block

IS the gray iron automotive engine block on the way out? A means of accomplishing this has been provided now with the first successful production of a one-piece, die cast aluminum engine block.

Straight cylinder engine blocks are being produced on an experimental basis at one of the Toledo plants of the Doehler-Jarvis Division of National Lead Company. Key to this new development is the company's "72-inch die casting machine" unveiled a little more than a year ago*.

The automotive industry is watching with close attention this new development. The engine block die cast in aluminum would show approximately ten percent price advantage over the conventional gray iron block, according to Frank J. Koegler, vice president of Doehler-Jarvis, and would have important advantages on the production line and in performance.

"Die cast aluminum is definitely a desirable material . . ."

M. F. MOORE

Vice President-Automotive
Research and Development
American Motors Corp.

"Die cast aluminum is definitely desirable as a material for an engine block. . . Present engines cannot readily be adapted to the use of aluminum blocks. The engine must be redesigned from the ground up with the specific idea that aluminum will be used in the construction of the block. Along with a completely new design of the engine, a complete realignment of production facilities would be required. . . The effect of an aluminum block on engine operation characteristics is generally good. . . The engine being used in the Mighty Mite, a military vehicle that is undergoing evaluation and tests by several of the military services, is a V-4 air-cooled engine in which the cylinder block and heads are designed to be die cast in aluminum. Operating characteristics have proven to be excellent and it has many commercial possibilities."

"Light weight and economic advantages . . . the most important 'pluses' "

FREDERICK H. MASON

Staff Metallurgist
Engineering Div.
Chrysler Corp.

"Die cast aluminum would be a desirable material for engine blocks primarily because of its light weight. . . In a general changeover to die-cast aluminum blocks, the engine would have to be completely redesigned and production tooling changed almost 100 percent. Once this was accomplished, we don't believe that there would be any significant production problems . . . benefits of light weight and possible economic advantages are the most important 'pluses' that would result from die-cast aluminum blocks (Rather than improvements in performance or engine efficiencies.) . . . The Chrysler Corp. is doing some investigative work; however, we would prefer not to make any more definite statement at this time."

"Main and camshaft bearing clearance may be quite a problem."

TOM SCHERGER

Chief Powerplant Engineer
Studebaker-Packard Corp.

"Die cast aluminum may be desirable as a cylinder block material to obtain a reduction in weight and machining costs. Many problems would have to be overcome and are being worked upon. This design would require the use of cast iron sleeves, wet or dry type, and this involves sealing problems due to difference in expansion between the two metals. This assumes that the engines would continue to use liquid cooling. . . The question of main and camshaft bearing clearance may have to be increased and an acceptable difference in noise level established. . . The weight factor is in favor of the use of aluminum. . . It is questionable whether the development of aluminum cylinder blocks will be in the production stage in less than five years. If all objections are overcome, such as differences in expansion, clearance, strength distribution, etc., economics will still be a factor. Die costs and new machinery will have to outweigh the relatively cheap cast iron, which has been with us a long time and has been doing an excellent job as cylinder block material."

. . . And What Auto Makers Say About It

This straight engine block weighs about 50 pounds as cast and 43 pounds when trimmed. This compares with approximately 175 pounds in gray iron. Not only does the lower specific gravity of aluminum figure into the weight saving, but the walls can be cast thinner and more accurate.

All holes are cored into the engine block die casting, so that not a single hole has to be drilled in the block. In all, 129 holes are cored. Machining is confined to the main sealing areas.

From the standpoint of performance, the heat conductivity of aluminum is much higher than gray iron and an engine block in the light weight metal requires a less complicated cooling system.

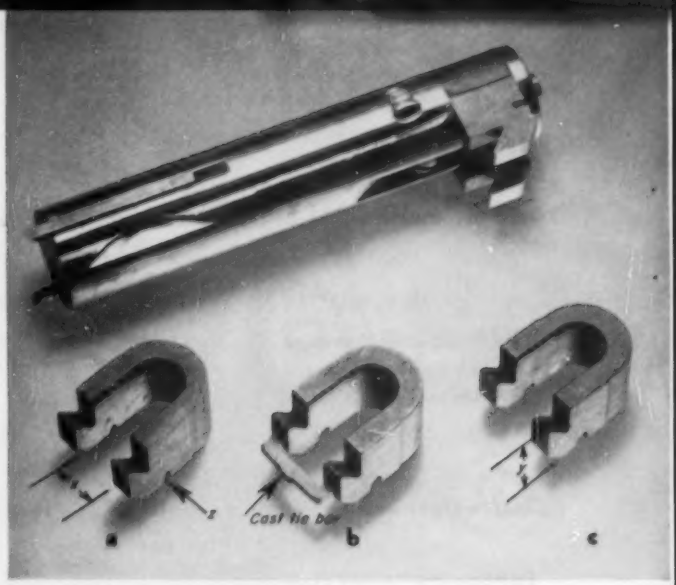
The inherent accuracy and uniformity of die castings also eliminates two problems common in sand cast iron: uncontrollable wall sections and sand pockets that restrict the flow of cooling water.

The new engine block can be produced at a rate of 30 to 35 pieces per hour on a single machine, according to A. F. Bauer, chief engineer at Doehler-Jarvis, who has been in charge of this development. At this rate, approximately 1700 pounds of molten aluminum are used per hour.

The die cast blocks will now undergo intensive testing and are expected to stand up under the stresses and other performance requirements as well as conventional gray iron blocks.

Based on their experience with the six cylinder engine blocks, development of a V-8 aluminum engine block which will weigh between 70 and 75 pounds is underway now.

* "Size Limits for Die Casting Extended by New Machine," PMM, Sept. 1954, pg. 110.



1. STAGES IN DEVELOPMENT of an investment casting for the breech lock include original difficulty in maintaining dimension "x", which was remedied by casting tie bar. Principal machining is grinding dimension "y".

Note to designers:
The casting salesman who calls on you may be able to help you with that new design on your drawing board. Here's the experience of a manufacturer who reports . . .

We Had To Be Taught

By CARL BENSON, Chief Engineer
O. F. Mossberg & Sons, Inc.

NEWEST SHOTGUN in the Mossberg line is this 12 gauge weapon that is getting wide acceptance by sportsmen.

WHEN you have a pair of shoes to sell—if the style is good, if the price is right, and if the shoes fit, the chances are that a prospective buyer can be sold on the first try. But if you are selling investment castings—even if the shoe fits, the chances are that it will take a number of calls before the first sale is made.

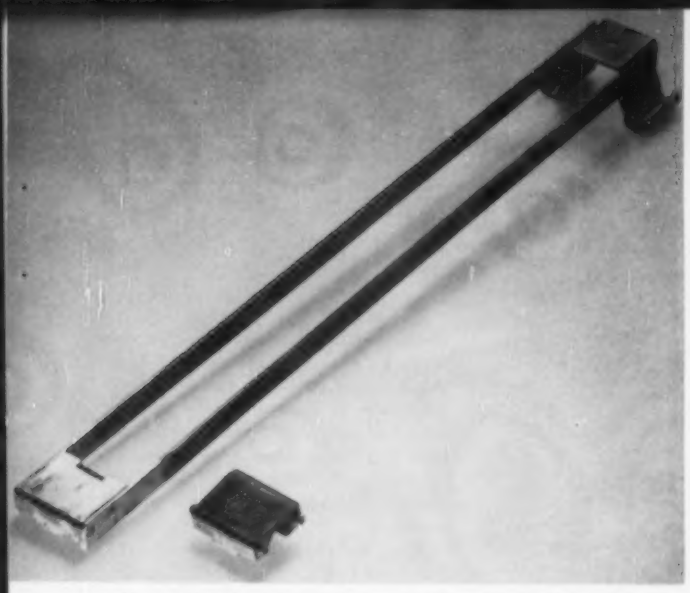
Our experience, at O. F. Mossberg & Sons, Inc., is probably typical. When the first investment casting salesman called on us there were two strikes on him. In the first place, no one in our company was sufficiently familiar with investment castings and the investment casting process to be able to evaluate it fairly. In the second place, a salesman wants to make a prompt sale—and to us it meant the conversion to investment casting of some part then in production by other methods.

Disregarding our lack of interest for the moment, to make a change in manufacturing methods in the midst of production is difficult. In many cases the part is being made economically and is satisfactory in performance—so why change? Further, there is almost always a set of special tools, jigs and fixtures that have been made and are in use; to scrap these when the manufacturing method is changed is throwing money away. The saving that a change makes must, therefore, be very large to allow the purchase of new tooling and the scrapping of old.

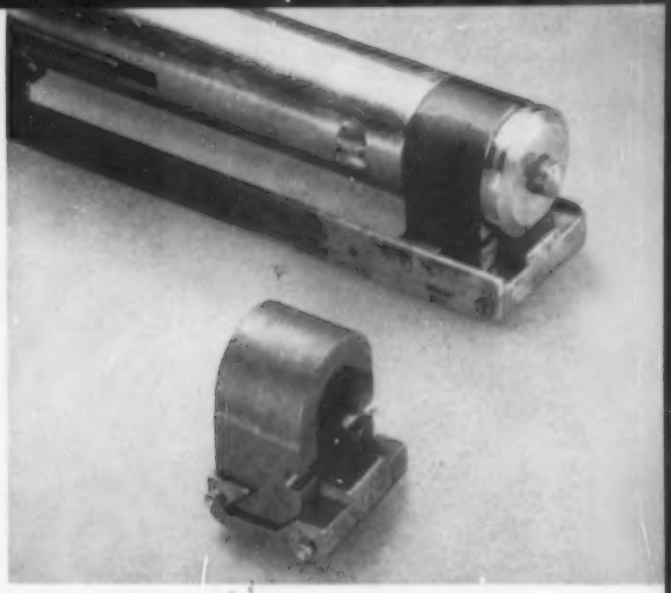
What actually happened is that through repeated calls by salesmen and reading in trade periodicals and journals our thinking was opened to this method. Then when a new product was contemplated we considered investment casting from the first as a possible manufacturing method. Thus we found that investment casting can reduce estimated manufacturing costs and can give the designer a degree of freedom that is not possible by any other economical manufacturing method.

The four investment castings used in the 12 gauge shot gun recently introduced by this company are evidence of how well a salesman educated our engineers and how this period of education paid off for everyone concerned.

In designing this new gun, two factors were foremost in the minds of company executives and design engineers. The gun had to meet the rigid requirements of safety, accuracy, and long life set up by the company and it also had to be made to sell at a moderate price so that sales volume would be high. Because of the excellent educational job that had been done by investment casting



2. CAST BOSSES on investment cast breech lock slide provide integral assembly means. These bosses are riveted over to complete the assembly. Undercuts cast accurately in this component would be expensive to machine.



3. MOST HEAVILY STRESSED component is the breech lock (U-shaped casting) shown here as it engages the breech lock side. Average chamber pressure of 19,000 psi is transmitted through the bolt to the lock.

How To Use Investment Castings

COVER STORY

sales engineers, the designers realized that certain components of the gun could be made by this process; that they would give highly satisfactory performance; that certain desirable design features could be included that would otherwise have to be either omitted or only approximated; and finally, that the elimination of several expensive machining operations would probably result in a materially lowered final cost.

Of the several different parts studied as possible investment castings, four were selected to be tried. All four parts are subject to considerable wear and stress and one is required to take the entire shock load of the recoil when the gun is fired.

As there was some question both as to possible performance and final costs on the investment cast parts, the first production was done using a single cavity mold to keep tool costs down.

This use of a single cavity mold had the further advantage of allowing engineering changes to be made at a minimum cost. Each of the investment cast parts will be separately discussed; all of them are made by the Hitchiner Mfg. Co., but in only one case will the progression from single to multiple cavity mold be covered. In all cases this same procedure was followed. The four parts are: the breech lock, the breech lock slide, the hammer and the sear.

Strength requirements

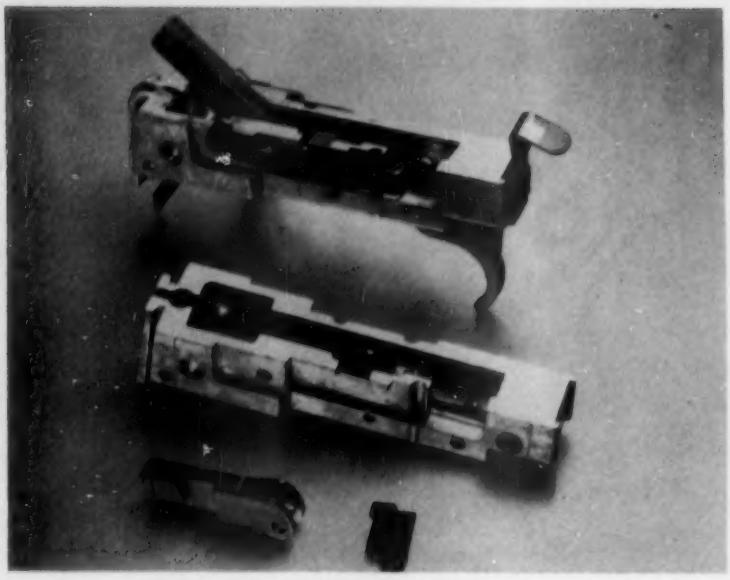
The breech lock, Figure 1, is one of the most severely stressed parts in the gun. As can be seen, it is mounted at the rear of the bolt and, when the bolt is closed and the gun ready to fire, the breech lock rises so that it engages an offset at the rear of the chamber. When the gun is fired, the entire force of the recoil is transmitted through the bolt to the breech lock. The amount of this force is not definitely known. What is known is that the average chamber pressure is about 11,000 psi and in some cases rises as high as 19,000 psi. A major portion of this pressure is transmitted through the bolt to the lock, where it must be carried as mostly a sheer stress by a relatively small area, certainly only a small fraction of a square inch.

The physical and mechanical properties of SAE 6150 steel, heat-treated to 45 Rockwell "C" were indicated as being fully adequate to take the estimated stresses with a good factor of safety. It remained to be seen, however, whether the cast and heat-treated structure of an investment casting would measure up.

Here the advantage of using a single cavity mold for early production proved its worth. The parts made could be tested, engineering and design changes made, and costs closely enough estimated to tell whether this method of manufacture was going to be satisfactory both from a performance and economy standpoint.

Taking strength requirements first, the investment cast parts soon proved to be thoroughly adequate for the intended service. Two design details that required changes were soon apparent. The small grooves indicated by the arrow, Figure 1z, presented a molding problem and were changed following discussion between the investment caster and the designers. The second problem was a tendency for the legs of the lock, dimension "x," to spread during cooling and subsequent heat-

Continued on next page



4. IMPACT AND WEAR are service conditions under which the investment cast hammer (left foreground) and sear (right foreground) must operate. Both of these components have proved equal to the job.

treatment. In some cases, this spread amounted to as much as 0.013. Since this could not be tolerated, it became necessary to coin each breech lock after heat-treatment, thus increasing manufacturing cost and setting up undesirable and unnecessary stresses.

The final solution to the problem was to cast the locks with a tie bar across the legs as shown in Figure 1b. This tie bar is kept on the lock until all heat treatment has been completed and the part is ready for final grinding.

In spite of the "nice" dimensional requirements of a piece such as this, and the generally good surface finish that is required on gun parts, only two grinding operations are required on the cast part. The thickness tolerances, dimension "y", are much closer than it is possible to cast by any method. The two surfaces must, therefore, be surface ground and the faces where the tie bar is cut off must be ground smooth.

When design and engineering changes had been made and a satisfactory part produced, a multiple cavity mold for polystyrene patterns was then made. This change from the single cavity to a multiple cavity mold resulted in cutting the cost of the investment cast part, as delivered, by 50 percent. This cost saving, incidentally, was characteristic of all four investment cast parts.

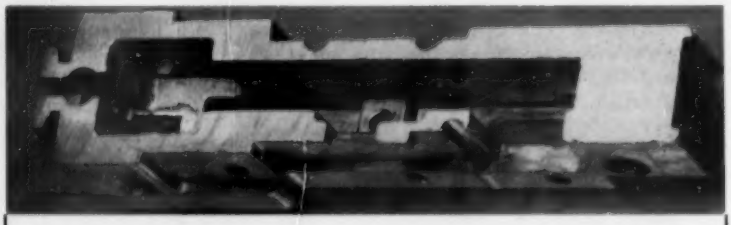
While this part was never made by regular machine shop methods, engineering estimates indicated a final cost reduction of 25 percent when investment cast. In addition to the direct monetary savings other savings were realized. To make the part from bar stock would have necessitated the purchase of new machine tools, required the design and construction of several expensive jigs and fixtures, and the stocking of strip stock. All of these costs were avoided.

The early models of this part were made from wrought stock by bending strip to shape and machining. Although trouble with the legs spreading during heat-treatment was noted, no good method of preventing it was found, as was found in the case of the investment castings.

Design Advantages

Figures 2 and 3 show the breech lock slide alone, mounted and in combination with the breech lock with which it engages in the gun.

Continued on page 80



AN ALUMINUM DIE CASTING MOUNTS THE WORKS

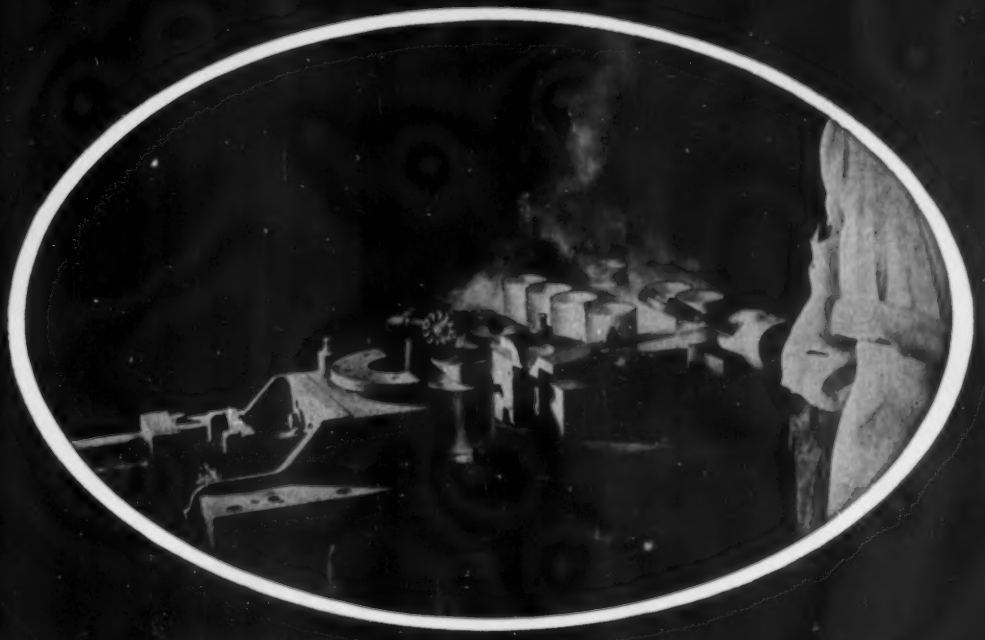
All of the moving parts of the Mossberg 12 gauge shotgun except the bolt are mounted in an aluminum die casting, whose dimensional stability assures proper center distances and surface relationships for the life of the weapon.

This casting, above, is shown in Figure 4 with some of pieces that mount in it. Of necessity, the part is highly complex in shape and if machined from bar stock or made as an assembly of two or more parts would represent an impossibly expensive machining job. By die casting, both the desired intricacy and accuracy can be easily achieved. The New England Die Casting Co., who makes the part, furnishes it completely finished except for drilling the holes and milling the top face on which the breech lock slide cam rides.

Many of the holes that are drilled could be cored but the added die costs and the somewhat slower rates of production of castings resulted in a piece of cost considerably higher than to make a simpler casting and drill the holes using a jig.

For more information circle No. 2 on the Reader Service Card ⟶

dag
DISPERSIONS



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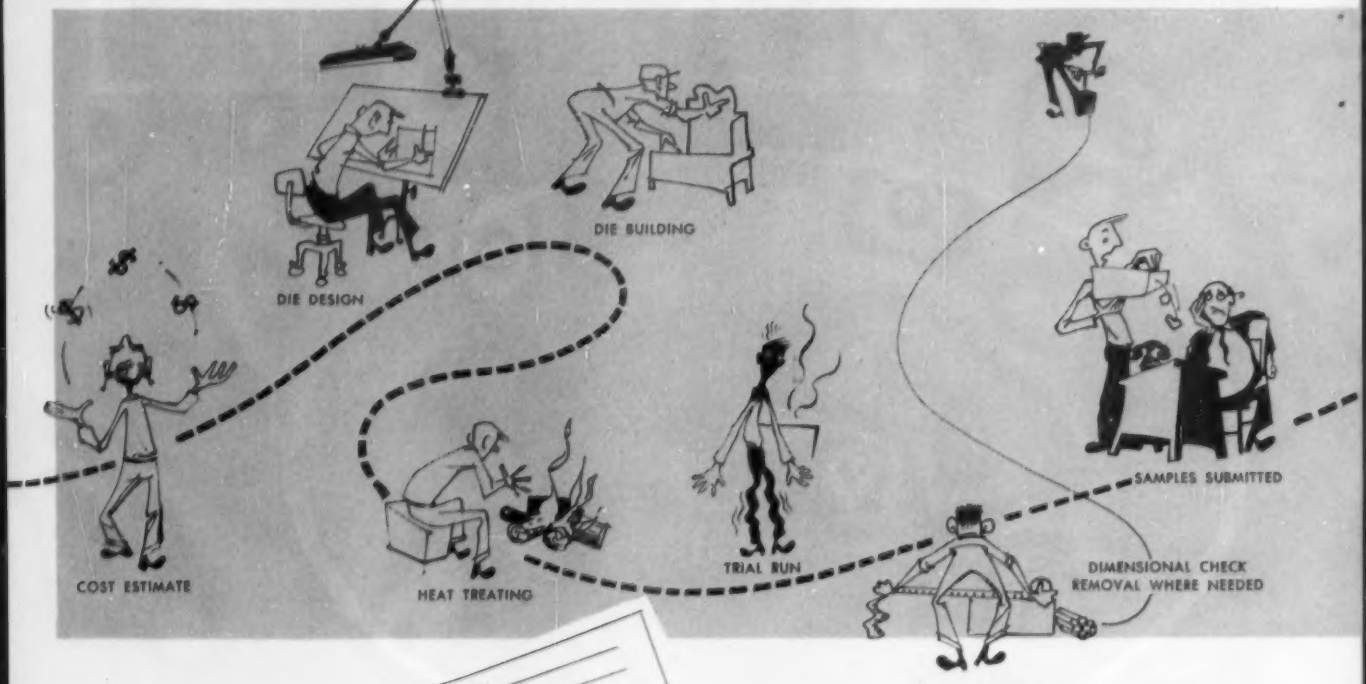
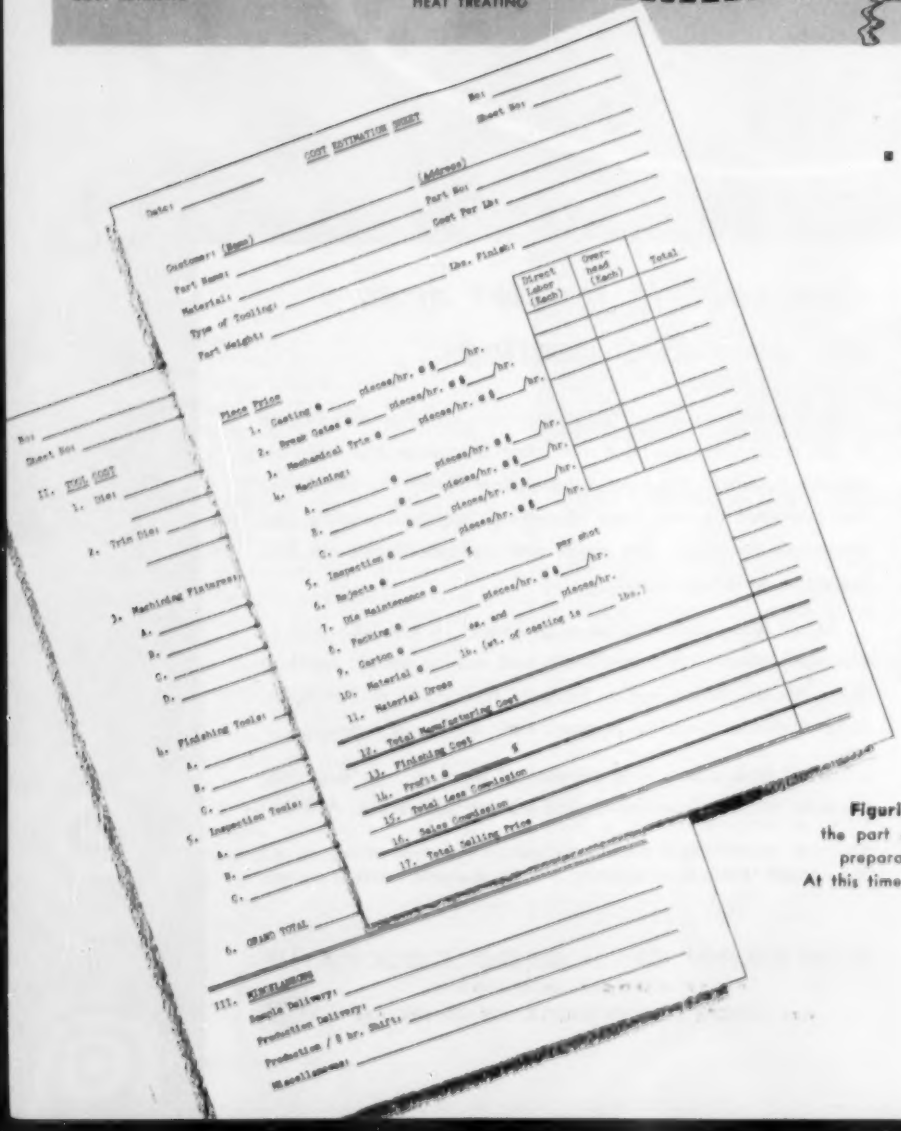
If You're Sweating Out A Shipment Of New Die Castings, Take



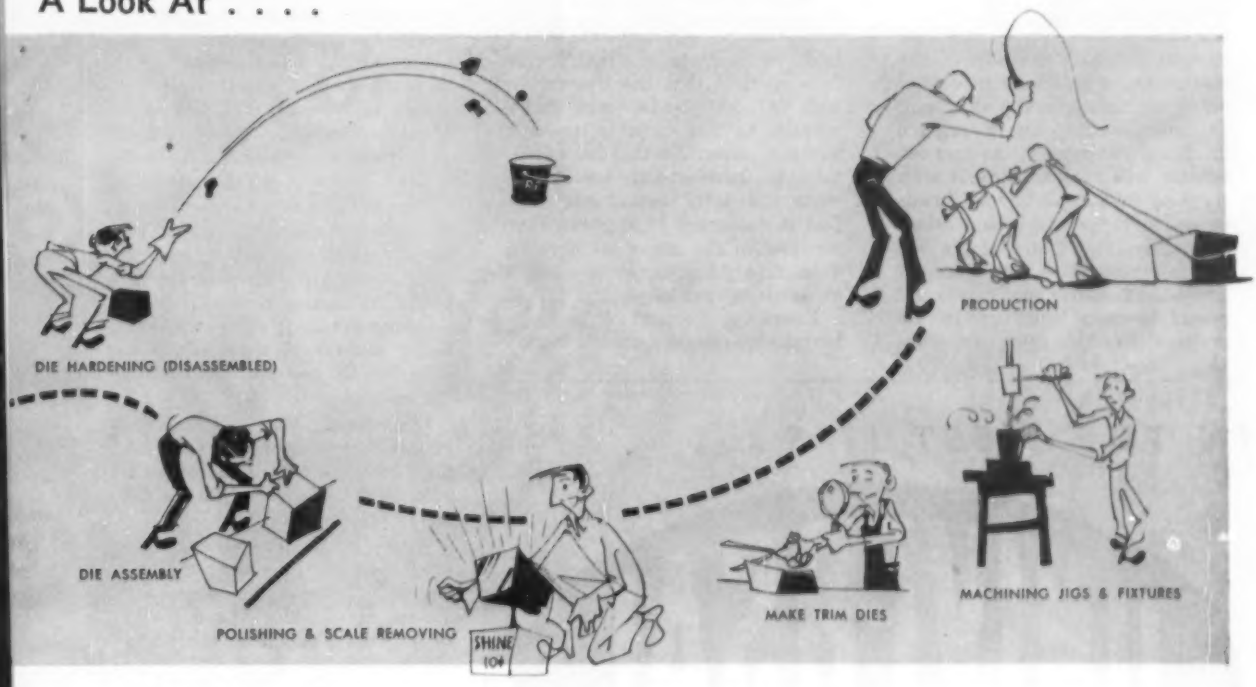
. . . What Goes



WHEN a die caster is asked to furnish a bid on a potential order for his plant, he states on his quotation a number of important items for the buyer's benefit; one of these is the *delivery time*, i. e. length of time he will require to engineer the die casting die design, construct the die, test run it, prepare the first samples and inspect them, effect any necessary corrections in the die, make the trim die, machining jigs and fixtures, etc., and make samples for the customer's inspectors to check.

Figuring Quotations requires careful study on the part of the jobbing die caster. All phases of preparation and production must be analyzed. At this time, delivery scheduling must be anticipated . . . a difficult procedure to predict.

A Look At . . . .



Into Delivery Scheduling

By JAMES L. ERICKSON

The die caster, if he is a capable one, will spend considerable time preparing his price proposal and in so doing he has to estimate the number of hours it will take him to make the necessary die or dies, etc. For the prospective purchaser to ask the die caster to shorten the sample preparation time (with or without overtime) by more than 10 to 15 per cent is inviting trouble. It must be borne in mind that the die caster's original estimate of the time he will require to build the necessary tools and prepare samples is only an *estimate*, and as such is subject to error—an error not always favoring a shorter die making and sample preparation period!

Once he appreciates the various preliminary steps that the die caster must take, a purchaser of die castings will learn to insist that his product designer and engineers complete their part designs and have final part prints completed and in the hands of his die cast parts buyer in sufficient time to permit him to properly "shop" the parts. And after the orders have been placed, plenty of time should be available for the die caster to get into production.

The length of time a die cast parts buyer ought to have to shop a given part cannot be discussed in detail here. But in order to perform his intended function (selecting the best possible source to make the die casting) all potential sources must be given an opportunity to prepare well thought out quotations.

The amount of time required to prepare a price proposal for one sort of part might be as much as 1/50 of the time required to prepare a price proposal for another sort of part. Let's see how this can be:

At the left is a typical price estimation form as employed by a die caster. This form is filled out by the die caster in detail and is used as the basis for the price proposal he submits to the potential purchaser of the part.

It is readily seen that it is much easier for the die caster to fill out this cost estimation form for a part of simple design which will be required by the customer only in the cast and trimmed condition than for a large complicated part which must be furnished to the customer completely machined, polished, buffed, plated, and finished in three different shades of baked-on organic paint.

It is not uncommon for a price proposal for a complex ornamental trim part to take four to six days to cost estimate! Included in this period of estimation is the time required to: a) Decide how the part is to be made and tooled (including studying the potential customer's specification for finishing the part), b) Estimate the time and cost of construction of the die, the trim die, the machining jigs and fixtures, c) Calculate the weight of the part, d) Estimate

the cost of die casting the raw part, e) Estimate the cost of the machining, f) Estimate the cost of polishing, buffing, and plating, and g) Estimate the cost of organic finishing. Frequently, the cost estimator will have to consult with three or four departmental heads in order to get their individual recommendations and advice before completing his estimation. A profit-making die caster will not resort to snap judgment in the preparation of his price proposals.

In instances where the die caster is asked to quote in a hurry it is only natural that the die caster will "play-it-safe" and make certain he has "put in enough money!" Even so, the die caster may still inadvertently underestimate the parts' actual cost and find it necessary to approach the die cast parts buyer at a later date for a price increase—always an unpleasant situation.

From the moment he receives his purchase order from the buyer, the die caster feels obligated to do everything possible to deliver sample parts on or before his promised delivery date in terms of a number of weeks—say 7-8 weeks, 9-10 weeks, or 12-14 weeks. If the die caster feels he can deliver a part in 10 weeks, he will quote a delivery of 9-11 weeks.

The die caster, after receiving the order, requests the buyer for a) additional part prints, b) any necessary style masters, c) templates, d) mating parts, e) specifications and/or f) color swatches. Delay in obtaining these may prevent the die caster from meeting his schedule.

Immediately, the die caster begins the preparation of his die design, and even before the design is completed, orders steel for the die blocks and inserts.

Where the parts to be made are small, chances are that the die caster will have the necessary die-set or die blocks and insert steel on hand and work can begin immediately.

Larger parts present a different problem; they may require the purchase of special forged die blocks of considerable size and cost. The procurement of these cannot be accomplished overnight, but frequently takes 4-6 weeks to obtain, when they must be prepared especially to order.

Occasionally a die casting die for a part, such as a complex carburetor body, will take 2-3 weeks to lay out. Most die designs, however, take at least 5-7 full days to complete. If the die design is completed before the die steel arrives, then a delay in the preparation of the die is unavoidable.

It is not feasible to attempt to shorten the die designing time by adding more draftsmen; there is no short cut to good die design.

Once the die maker receives a set of die design prints, he goes to work. Usually the die shop foreman will assign one good man to build the die. In the case of *rush* jobs the foreman may split up the die construction and give the task of making certain of the less-critical components to subordinates while one die maker is responsible for cutting the actual die cavities. The number of die makers that the foreman can put to work on a die depends upon the design, size, and intricacies of the die. Small nameplate dies are

Continued on page 64

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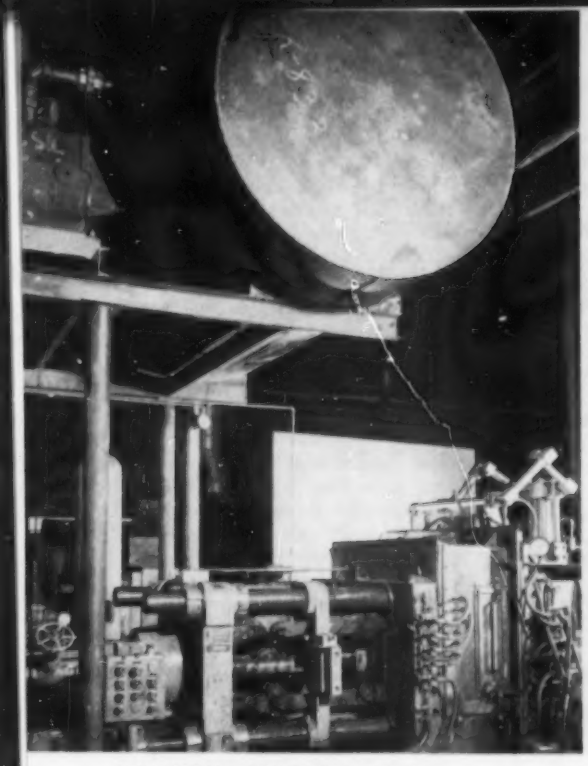


Massive evacuation with this vacuum pump and oversize tank . . .

. . . pulls all air from the die area to avoid gas entrapment

Vacuum Die Casting

. . . a progress report

ON EXISTING EQUIPMENT and dies, a vacuum hood and evacuating system have been installed. This 450-ton B & T machine cycles at rates comparable to those without vacuum installation.

NEARLY two years ago, PMM first told its readers about a new process by which zinc alloy die castings were being produced under vacuum*. At that time, pilot runs had been made, physical tests had been completed and some general conclusions about the potential usefulness of the process were advanced.

Checking back now with Nelmor Manufacturing Corp., in whose plant the vacuum die casting development work was carried out, it has been learned that:

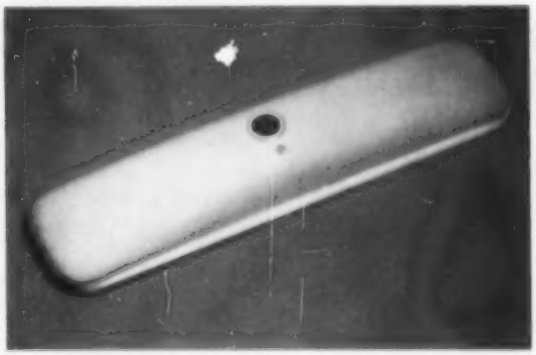
1. Several production jobs have been running for more than a year, with marked reduction in percent of scrap due to surface defects.
2. Certain changes have been made in the vacuum technique to permit more rapid and efficient operation.
3. The company is now ready to license other die casters to use the process on a non-exclusive basis.
4. A manufacturer of standard die casting machines will produce units having this vacuum equipment.
5. One British jobbing die caster is producing die castings under a license agreement.
6. Work is being pressed on vacuum die casting system for aluminum and magnesium.

Here, are features of the Vacaloy Process, as it is called by Nelmor, together with a review of the company's findings based on two years of experience.

Vacuum equipment has been installed on two machines at the company's plant, with others soon to be converted from standard to vacuum operation. Use of this

* "Vacuum Die Casting," PMM, pg. 91, Mar. 1954.

REJECTS RAN HIGH due to difficulty of getting good surface quality on this very thin-walled casting using non-vacuum operation. Now rejects for surface finish defects are almost eliminated.



COMPETING WITH A STAMPING, this mirror-back is cheaper as a die casting, now that walls have been thinned down to an average .035 thickness. Vacuum operation is credited with this accomplishment.

vacuum die casting system does not require changes in either the dies or the machines on which they are installed.

During early stages of development, it had been necessary to slow the cycle while vacuum was applied, but newer developments made it possible to operate the die casting machine at practically normal speeds. One job, now in production on a 450 ton B & T die casting machine, runs at a rate of 175 to 200 shots per hour.

Arrangements have been made to allow adjustment for variations in depth of dies.

For dies having core movements that extend beyond the normal dimensions of the vacuum hood, box arrangements have been provided.

The company reports that die break-in and testing time is reduced substantially, since the use of vacuum removes most causes for removing the die for rework, such as providing vents, adjusting gate thickness, eliminating air entrapment, etc.

Lower injection pressures are said to be practical to achieve a given casting density, due to the fact that a large part of the injection pressure in conventional die casting is spent in compressing air in the die cavity.

Perfect sealing is not critical, because the massive vacuum applied for a very brief interval is sufficient to achieve good castings. Leakage after this moment of injection is unimportant and can have no effect upon casting quality. Elaborate inspection and maintenance of sealing is not required.

What Is Accomplished?

The foreman of the polishing room says that his men know when vacuum die castings are being processed, without being told. Differences in surface quality and reduction in number of sub-surface defects are very noticeable. So far, castings being produced under vacuum conditions are mainly ones that had given difficulty previously with normal casting methods. The company claims that rejects have been drastically lowered.

Some examples of die castings currently in production by the new system are illustrated. Each of these previously caused trouble due to thin walls combined with requirement of high quality surface finish.

One direct result of using vacuum has been a reduction in the standard limit on minimum wall thickness. Previously, a casting that required hardware quality surface had to be .050 minimum thickness, but this has now been cut to .035, which represents a saving in metal.

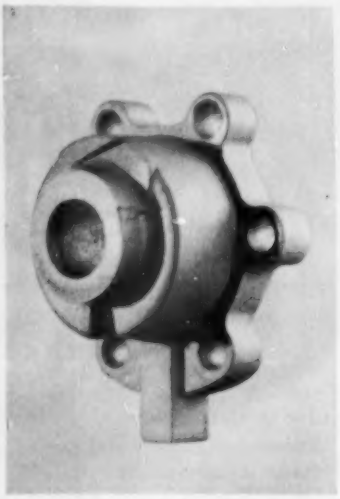
Actually, the thinner casting is not less strong than its heavier predecessor because a larger percentage of the wall section is made up of the dense, chilled metal. Laboratory tests show an improvement in tensile strength and hardness in the castings produced under vacuum.

Two principal advantages are pointed out by the company: improvement of surface quality on castings that are to be finished; improvement of internal structure with regard to porosity in castings that must resist pressures or leakage of gases or liquids.

From a production viewpoint, two additional effects of introducing vacuum have been noted: 1) the unbalanced condition which sometimes results from using unit dies with one or more cavity plugged can be overcome; and 2) larger castings appear to be practical without increasing injection pressure.

Are You Investigating Costs?

INVESTMENT CASTING MAY BE YOUR ANSWER...



This housing for a non-lubricating lift plug valve is cast in 4140 steel. It is annealed and normalized prior to machining and final heat treatment. If the part were made from bar stock or a forging, scrap losses would be very high and machining costs would be multiplied many times over that now needed to finish this 1½-pound investment casting.

If the rising costs of materials and labor have you concerned, you certainly ought to investigate investment castings. A good place to start your investigation is any part on which multiple machining operations are now required. Your re-evaluation will point out the ways that investment castings can save production dollars: close tolerances, fine surface finishes and soundness are assured. And complete quality control facilities are available to safeguard your savings.

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TABLE 1

These eight control requirements must be agreed upon by buyer and vendor in order to produce aircraft quality investment castings

Dimensions of nonmachined cast sections
Stock distribution on machined surfaces
Casting surface finish
Material specification
Radiographic soundness
Visual inspection standards
Fluorescent penetrant inspection
Identification requirements

Quality Control Of Investment Castings

By CHARLES YAKER, Plant Manager
Misco Precision Casting Company

QUALITY CONTROL of investment casting is best considered in relation to investment castings of the type commonly used in aircraft as turbines. With these castings, control of quality is extremely important because of the requirements for great physical strength and precise dimensions. Moreover, since a large percentage of investment castings is made for use in gas turbines, a discussion of quality control of these castings has wide application in the investment casting industry.

In order to produce a satisfactory part, the foundry must satisfy the requirements listed in Table 1 above. These requirements must be mutually agreeable to both the producer and the buyer. In fact, the first step before producing the part is reaching an agreement on the limits or controls to be met on each of the items.

The first three items—dimensions of nonmachined sections, stock distribution on machined surfaces, and surface finish—are generally agreed upon during the purchase negotiations for a part. The buyers should present their requirements for these items on the blueprint submitted to the foundry. In the quotation submitted for the part, the foundry will list any necessary deviations it will require on these items. The requested deviations will be made on the basis of the limitations of the investment-casting process and the experience the foundry has had with similar parts.

By using the available data on dimensional tolerances for investment casting, the engineer can, in designing a part, make sure that he will be able to obtain the part without deviations from the blueprint. To obtain the best results, the buyer should make an investment-casting drawing of the part before submitting the part for quotation to the investment-casting foundry. This drawing should be made to the tolerances realizable by investment casting and should show the distribution and the amount of machining stock on the part.

The next requirement which must be mutually agreed upon is the material specification. Specification of material is of utmost importance and sometimes requires considerable negotiation between the buyer and the foundry. If a part is to be produced in a heat-resistant alloy of iron-base, cobalt-base, or nickel-base composition, a number of material specifications are available specifically tailored for investment casting. These materials are well covered in the Aeronautical Material Specifications of the Society of Automotive Engineers (SAE). Material specifications suitable for investment casting in all classes of alloys are also being developed by the Investment Casting Institute through its Metal Specifications Committee.

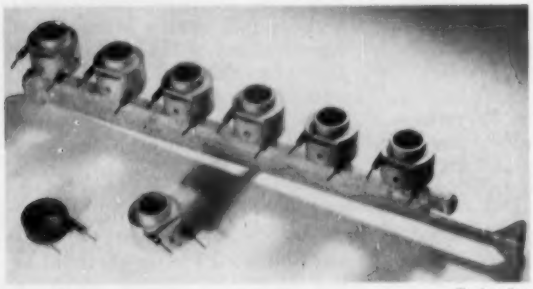
If the engineer uses an AMS specification for an investment-cast alloy, the investment casting foundry will usually accept these specifications with no deviation. But when the engineer has been obtaining a part in the wrought form and turns to investment casting for the part, he will very likely find that he is unable to find an investment-casting specification for the identical alloy. The purchaser therefore will often request the same material in the investment casting which he previously obtained in the wrought part. However, because of the nature of the investment casting process, the wrought composition for a material cannot always be supplied, and the foundry will either request a deviation in composition or suggest a substitute material. The investment casting foundry, in requesting deviations, will generally require variations in composition which will improve the castability and soundness of the part. These variations will generally result in equal or better physical properties than those obtainable from the material originally specified.

Continued on page 79

Mr. Yaker's paper, delivered as part of a program by the Investment Casting Institute before the Sandia Corp., central research and development agency of the AEC, will be presented in three installments in PMM. Mr. Yaker covers the basic points of agreement between buyer and producer of investment castings.

Eastern Casting Corp.

UNDERCUTS in this large-size semi-permanent mold casting are produced with sand cores, a feature which permits greater latitude in designing.



Exalco, Inc.

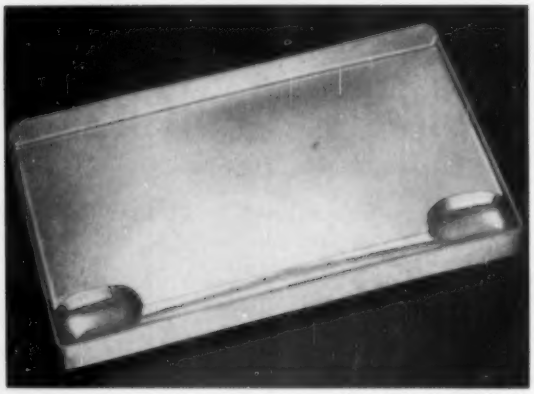
CAST-IN INSERTS, such as the ones in this coffee percolator casting, make possible most of the expanding line of appliances with integral heating systems now on the market. Density and water-tightness are additional requirements of these units which accomplish rapid heating of coffee.

Milwaukee Gas Specialty Co.

PRESSURE TIGHTNESS, due to the fine grain structure and good metallurgical quality of permanent mold castings, has been responsible for an increasing use of this type of component in hydraulic systems. These valves are typical of a wide range of such pieces.

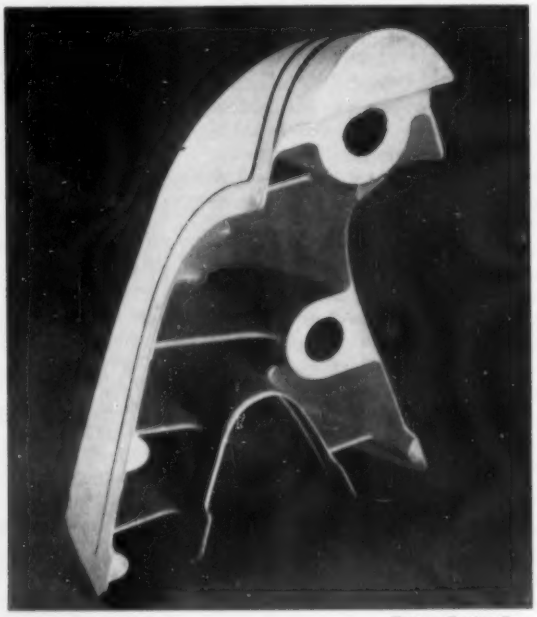
Excellent metallurgical characteristics, plus unique design flexibility, are reasons more designers are turning to . . .

Permanent



Monarch Aluminum Mfg. Co.

STOVE-TOP WARE, such as this grille, are among the important applications for aluminum permanent mold castings due to excellent, dense metal structure.



Eastern Casting Corp.

MILITARY AIRCRAFT applications utilize the lightness and strength of aluminum in conjunction with the intricacy and large sizes that are practical by permanent mold casting. This is an aircraft machine gun mount and structural member.

Mold.....Casting Process With A Future

IF permanent mold casting were strictly an "in-between" process as some designers believe, applicable only when quantities of pieces are too high for sand casting but too low to pay for die casting dies . . . then it would be difficult to account for the steady increase in tonnage of permanent mold castings produced during the past several years.

Figures of the U. S. Department of Commerce* show that the 146,883,000 pounds of aluminum cast in permanent molds in 1952 represented 28.31 percent of all aluminum cast. Two years later, these figures had risen . . . 214,408,000 pounds of permanent mold castings made up 35.17 percent of all aluminum castings shipped . . . a larger share of a larger total output!

By the end of the third quarter of 1955, permanent mold castings constituted a healthy 36.6 percent of all aluminum castings shipped.

To find the reasons for this steady increase in application of aluminum permanent mold castings, the editors of PMM have checked with designers, buyers and producers of these castings. New fields of application have been noted, as well as expanded use of some of the more conventional types of permanent mold castings.

Two special, inherent advantages of permanent mold castings have been consistently pointed out, both by users and producers of these castings, as the most influential factors in their specification: 1) Superior metallurgical quality, and 2) Design freedom due to the method of constructing and operating the mold.

The boom in car sales has certainly been part of the reason for the big 1955 sales of aluminum permanent mold castings . . . but the steady pattern of increasing sales over the past several years indicates that other influences are also present.

Most of the gain in shipments of permanent mold castings appears to have been at the expense of sand castings; in four years, sand castings have dropped steadily from 37.49 to 20.3 percent of all aluminum cast. This is part of a general trend toward the specification of more precise types of castings as rising labor rates push the cost of machining and finishing rough sand castings far above the economic ceiling.

Automobiles continue to take the largest part of the output of permanent mold castings . . . 69.7 percent during the first six months of 1955, as compared to 66.8 and 62.9 percent during the first and second halves of 1954, respectively. These figures are contained in a recent report by the Aluminum Association covering end-use statistics on aluminum wrought and cast products.

Second in the consumption of aluminum permanent mold castings, as might be expected, is in the category including home appliances, furnishings and equipment. This accounts for 11.2 percent of the total during the first half of 1955. The only category in which permanent mold castings show a much smaller percentage during the past year is national defense, now taking only 4.9 percent of aluminum permanent mold castings, as compared to 9.9 percent during the last half of 1954.

Some of the new applications of this type of casting, either in current production or being tool-

Continued next page

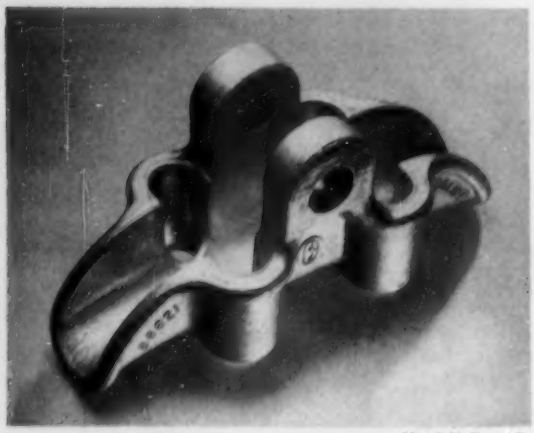
* "Facts For Industry," Series M24E, Non-Ferrous Castings, prepared by Bureau of Census, Industry Div., Primary Metal and Intermediate Metal Products Sect., U. S. Dept. of Commerce.

ALUMINUM MOLD PRODUCTION . . .**

YEAR	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	TOTAL
1953	12,211	16,752	17,912	18,628	16,528	16,528	15,692	16,252	17,189	17,030	15,396	16,907	200,025
1954	16,615	17,301	19,606	18,131	16,362	17,165	13,819	15,415	16,731	19,238	20,396	23,629	214,408
1955	23,679	24,319	29,029	28,028	25,597	24,682	21,006	22,267	23,075				

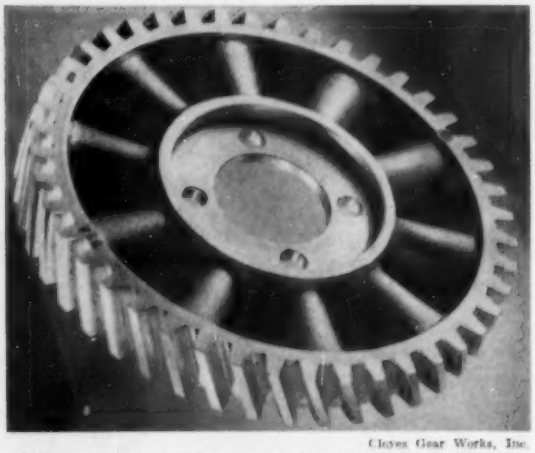
**U.S. Department of Commerce

(All figures in thousands of pounds)



Mansfield Brass Co.

CABLE CLAMP requires substantial strength and ruggedness, readily obtained from an aluminum permanent mold casting. Complex shape, cross holes, clean lettering detail, are all obtained without extra machining.

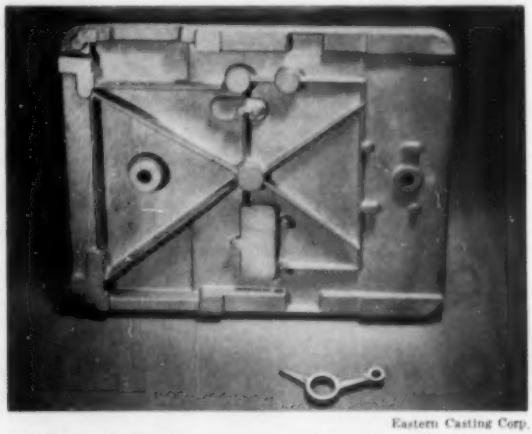


Cleves Gear Works, Inc.

MORE ACCURATE GEAR with better sliding action and minimum of noise is made by an aluminum permanent mold blank with shaved teeth. This type of timing gear for truck engines is used by several major automotive companies for strength.

Monarch Aluminum Mfg. Co.

BEST HEAT TRANSMISSION characteristics are obtained today by casting heating elements as inserts to establish intimate contact between the heat source and the aluminum. This makes a very efficient cooking utensil.



Eastern Casting Corp.

LARGE AND SMALL size permanent mold castings are well illustrated by this comparison between a base for a modern business machine, and a small connecting rod. Extremely long life is reported for the connecting rod.

ed up at the present time, are: Components for street lighting equipment, highway bridge railings and architectural railings, as replacements of cement, iron and steel; Connecting rods used directly as bearings without babbitt (said to out-wear hardened steel wrist pins;) Business machine components, especially the large mounting bases for complex units; Air conditioning equipment; Automatic cooking appliances with cast-in heating elements; Structural components used in power transmission systems; Hydraulic valve housings and related components.

New technical developments are having an influence on the expansion of usage for permanent mold castings, while other developments will soon add impetus to this trend. For example, the widespread introduction of hydraulic actuation for pulling cores, opening and closing molds and ejecting castings speeds the casting cycle and thus, permits a lowering of costs. This use of hydraulic or pneumatic devices makes the initial tooling more expensive, but, as a result, makes higher production rates possible. Long run jobs easily pay for the mechanization.

New technical developments extend process range

According to the chief engineer of Standard Machinery Co., "Improved mold operating machines providing both initial and sustained accuracy, together with higher clamping and unclamping pressures and with automatic cycle timing, will stimulate usage

because of reduced costs." In this respect, permanent mold casting approaches the automatic character of die casting, but retains gravity-pouring.

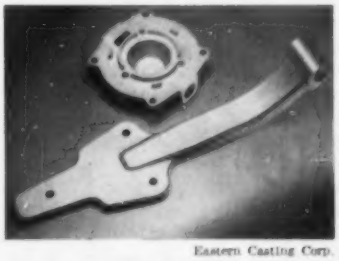
Further evidence of mechanization is a new continuous-pour automatic furnace[1] primarily directed toward high production output.

New mold materials have likewise been introduced, having their influence on mold-life, precision and initial cost. Some of these developments[2] have already had extensive production testing. Gravity-pouring machines in which the molds are clamped to the spout of a tilting type melting furnace also have had increasing application in producing permanent mold castings[3].

Among the important new developments that will help to encourage more designers to turn to permanent mold castings are techniques for surface finishing, such as application of vitreous enamel[4], application of hard chromium plating on wear surfaces, and a method for bonding ferrous materials to aluminum (a development which will soon be covered in detail in PMM).

Permanent mold casting is a gravity casting method using metal molds. A variation of the process, called semi-permanent mold, differs in the use of sand cores within the metal molds, permitting the casting of undercuts and other internal configurations not possible with metal cores.

Flexibility of the process, from the design viewpoint, arises from the fact that the mold is generally designed "around the casting" without the limiting features of a rigid machine to be considered. Thus, if undercuts would prevent the withdrawal of a casting from a simple two part mold, it is possible to design a mold with radial segments that withdraw to clear side undercuts. The combination of metal mold and sand core also allows other design features, although introducing a lower factor of accuracy.



Eastern Casting Corp.

INSERTS other than heating elements are also practical; Hex nuts, and bushings are cast in place in these two pieces.

For designers... soundness is the key feature

Possibly the most important attribute for designers is the uniformly sound, dense internal structure obtained from the relatively slow chill of the casting. This accounts for the widespread use of aluminum permanent mold castings for such applications as hydraulic valves, pump housings and aircraft components. Also, where castings require substantial amounts of machining into solid portions of the casting, as boring through a solid boss, the permanent mold casting will result in very low rates of rejects due to opening up blowholes or other internal porosity.

The range of aluminum alloys that can be permanent mold cast is practically as great as those that can be sand cast, thus offering the designer a choice of properties and chemical compositions.

The trend in use of aluminum permanent mold castings cannot be regarded as temporary. While the automotive production picture is partly responsible, the basis for the acceptance of permanent mold castings is largely on their merits on an engineering and cost basis. Uses other than automotive will continue to grow, particularly as new technical developments provide castings with improved properties, lower costs and higher accuracy.

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[1] "Continuous Melting and Automatic Pouring", PMM, Sept. 1955, pg. 109

[2] "Refractory Material for Permanent Molds", PMM, Oct. 1955, pg. 103 and "Economical Mold Material for Accurate Casting of Aluminum Alloys", PMM, July 1954, pg. 81

[3] "Castings for Aircraft Hydraulic Systems", PMM, Aug. 1955, pg. 77

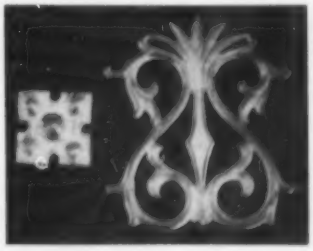
[4] "Vitreous Enamel for Aluminum Permanent Mold Castings", PMM, Apr. 1955, pg. 60

Choice of Metals In Permanent Mold

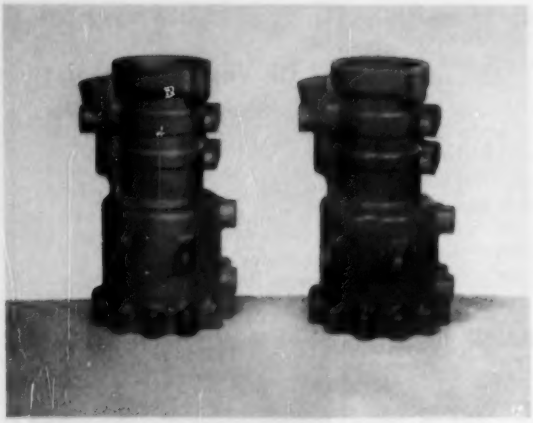
OTHER non-ferrous metals that are being successfully cast in permanent molds illustrate the increasing application of this process by designers.

MAGNESIUM alloy is used for a balance on arm for a meter, manufactured by Bailey Meter Co.

COPPER BASE alloys are permanent mold cast to produce these non-sparking tools used where danger of fire or explosion exists. Manufacturer is Alcaloy, Inc.



LEAD-ANTIMONY castings are used for escutcheons on lighting fixtures because of good finish and ability to cold form the finished casting. Made by Novelty Lighting Corp.



WAX PATTERN (right) and stainless steel casting by Misco Precision Casting Co., indicate the intricate contours and good surface detail that can be obtained.

Photos from Investment Casting Institute

TURBINE VANE cast in superalloy by Misco, shown with its wax pattern (right) reveals the thin section and sharp trailing edge that create special problems.

Expendable Pattern Materials For Investment Casting

By C. D. MURPHY, Jr.
Bareco Wax Co., Div. Petrolite Corp.

THE "Lost Wax" or expendable pattern process of duplicating an object in metal is neither new nor recent, but this process, used by the craftsmen of ancient China and Egypt, has only recently been transformed into a true modern industrial process.

This process, which became a tool of some of the greatest artists of all times and, in more recent times, of the dental and jewelry trades, is based upon carving or shaping in wax a facsimile of the item to be cast. The mold is formed around it in a ceramic material known as the "investment," which, after hardening, is heated to melt out the wax pattern material. In the cavity thus provided, the metal is poured.

Transformation of this process whereby accurate but non-duplicable castings were made, into a mass production process, awaited the development of injection molding techniques whereby large numbers of identical wax patterns can be produced.

The sequence of operations in this process which not simplifies many manufacturing problems for the designer and production engineer, begins with the master pattern. A permanent die is made by machining a negative of its shape into steel or other metal. Wax is injected into this cavity at desired temperature and pressure and, upon solidification, is removed from the die. A cluster of these patterns, joined together with a similar wax material, is placed in a flask and surrounded by a wet ceramic material. When this is baked to be hardened, the wax is melted out, after which a burn-out follows to assure more complete removal of wax residue.

The ceramic mold is then heated to casting temperature and molten metal cast, using various techniques of gravity pouring, centrifugal action, pressure or vacuum. After cooling, the investment is removed from the solid metal part with a pneumatic hammer, sprues and gates are cut away, and finishing such as machining, grinding, or plating completes the cycle.

The nature of the precision casting technique is based on the one time use of expendable patterns and investment molds. It follows that the elimination of high rejection rates all along the line is the most effective approach to lower costs. Most rejections of investment cast parts are for these reasons: dimensions outside allowable tolerances, surface defects, sub-surface defects, poor surface finish, insufficient detail and lack of sharp outline. Since an imperfect pattern can cause any or all these and other defects, the development of dependable pattern materials was obviously the starting point in decreasing reject rates.

Disposable pattern materials for precision investment castings are for the most part drawn from three general classes of materials: waxes, thermoplastic polymers and mercury. All of these materials have a place in the art, but this discussion will deal almost exclusively with the role of microcrystalline waxes of petroleum origin as a pattern material.

It is not by coincidence that wax, the most satisfactory substance used by the ancient artisans, is again the most successful and widely used single material employed in the construction of patterns today. But, as the entire investment casting process has been modernized, so that the wax of which the patterns are made. If precision tolerances are to be maintained, a pattern material with precision characteristics must be used.

Here Are 21 Properties Required Of A Modern Pattern Material...

The pattern material, in addition to its ability to reproduce and maintain the dimensions and contours of the master pattern, must have the following characteristics:

1. PROPER STRENGTH. Strength is essential in order that broken and distorted patterns be avoided in normal handling and storage.
2. TOUGHNESS AND RESILIENCY. These properties are necessary in order that proper contour and dimension be resumed after any temporary deflection.
3. MODLABILITY. The pattern must possess a smooth surface minimize mechanical finishing.
4. EXPENDABILITY. The pattern must volatilize and be readily combustible during burnout in order that the mold be purged of all pattern material prior to casting.
5. PROPER SOLIDIFICATION CONDUCT. The semi-molten pattern material must solidify rapidly enough to facilitate production yet retain other vital chilling characteristics, such as low shrinkage and flowability.
6. LOW SHRINKAGE. The volume shrinkage must be low, from the molding temperature to the solid phase, in order that shrinkage beyond allowable tolerance be avoided.
7. ANTI-BLOCKING. The finished patterns must not have a tacky surface. If the material has a blocking tendency the patterns are prone to surface deformity during assembly.
8. UNIFORMITY. The uniformity of the critical pattern, of necessity, depends on the uniformity of the pattern materials used.
9. WELDABILITY. The wax must heat-weld easily to eliminate an undesirable amount of labor in the assembly of the mold cluster.
10. AGING CHARACTER. Some materials have a prolonged period of crystal growth which results in gradual contour and dimension change. Proper selection will eliminate this hazard.
11. EXTENDED MELTING RANGE. A melting range that is not too sharp allows for normal variation in heat controls and eliminates much trouble due to excessively fast solidification.
12. STABILITY TO NORMAL TEMPERATURE. The pattern material must have a melting point high enough to avoid undue softening during hot weather and at plant handling temperatures.
13. WETABILITY. The pattern should be easily wetted by the investment material to eliminate bubble formation on the pattern surface and the ensuing defect in the finished casting.
14. LOW ASH CONTENT. Mineral ash residue can cause serious casting defects. Pattern material of mimimum ash content is desirable.
15. FLOWABILITY. The material at injection temperature must flow readily to insure reproduction of intricate detail. Good flow also allows lower injection pressures and compensates for contraction as solidification takes place.
16. LOW COST PER POUND. Due to the advantages of its non-recovery, pattern material of a low initial cost is especially desirable.

Continued next page

TABLE 1

PHYSICAL AND CHEMICAL PROPERTIES	PATTERN WAX COMPOUND A	B	C	D	E	F
Congealing Point °F. ASTM D938-49	195	180	163	165	150	160
Melting Point °F. ASTM D127-49	195.7	181.7	180.0	176.9	173.3	---
Penetration at 77°F ASTM D5-25	4.5	6.0	4.5	9.0	6.0	6.5
Viscosity at 210°F SUS ASTM D88-44	237	Very High	207·	91.0	90.0	75
Acid Number	1.5	4.7	5.5	2.7	2.7	---
Saponification Number	25.5	102.0	23.4	25.5	27.3	---

TABLE 2

PATTERN WAX COMPOUNDS
PER CENT VOLUME EXPANSION FROM 80°F.

Temperature °F	Comp. A	Comp. B	Comp. C	Comp. D	Comp. E	Comp. F
80	0.0	0.0	0.0	0.0	0.0	0.0
100	1.0	0.7	0.9	0.8	1.2	0.8
120	3.3	2.0	2.5	2.6	5.0	2.3
140	7.5	4.3	6.3	6.4	9.7	5.9
160	9.4	6.8	9.4	10.7	11.6	12.7
180	10.1	9.4	10.6	13.0	13.1	14.2
200	11.0	10.6	11.4	14.1	14.2	15.0

17. VOLATILITY. Proper pattern material should not contain volatiles which will be lost if held at molten temperatures for several hours. This loss might result in excessive brittleness. On the other hand all the pattern material should be completely volatile in the burn-out procedure.

18. FUMES. Selection of pattern material should be made so that burn-out produces a minimum of offensive odors and toxic fumes.

19. RELEASE. The pattern material must have proper qualities for giving easy mechanical release of the pattern from the die.

20. INTERNAL STRESSES. The material must have maximum ability to dissipate, during cooling, any stresses which could result in distortion.

21. SEDIMENTATION. No component should settle out during heat cycling, as this would tend to clog injection nozzles.

All the characteristics listed above must be closely approached by a given substance in order that it be suitable for a pattern material. In view of these stringent requirements it becomes apparent that a wax or thermoplastic material which behaves as a good investment casting pattern is not an accident, but is the product of exhaustive research and development. To perform in a uniform manner, a pattern wax must be formulated from materials which are carefully controlled to deliver consistent results at all times.

The large majority of expendable patterns are produced from waxes, thermoplastics and frozen mercury. the technique which employs frozen mercury as a pattern material is patented, and information on the process is available in other literature. It must be recognized as a unique and workable process which has a definite place in the industry.

The process involving the use of of thermoplastic materials such as polystyrene, polyethylene, vinyl compounds, etc., does not differ greatly from that involving waxes. Much higher injection pressures are generally required with the thermoplastics, resulting in a much higher cost for dies. These materials have proved their value in certain specific applications and have accordingly earned a rightful place in the field. Their use is largely limited to long runs, as the high costs involved make these materials uneconomical for short run applications.

The key to the whole precision investment casting process is the multiple reproduction of an accurate pattern. To accomplish this, wax compounds have won general acceptance because of low cost, low injection temperature, low injection pressure, minimum dwell period, and other advantages.

In general, wax compounds closely comply with more of the requirements of an ideal pattern material, as outlined, than any other material or class of materials. The wax compounds, which now make up the largest volume for investment casting, are homogenuous materials which lend themselves to uniform injection

Continued on page 82

YESTERDAY
TOMORROW
The Trend is with Badger...
BADGER quality makes your product more competitive!
• Zinc and Aluminum Die Castings •
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They redesigned from aluminum bar to die cast zinc

Without Weight Increase

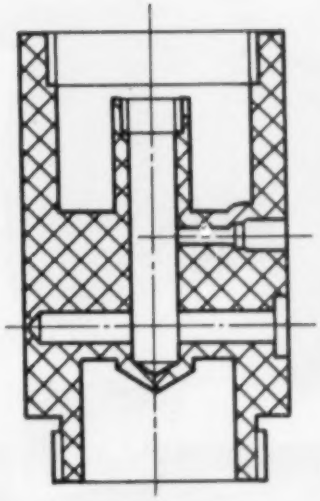
ALTHOUGH the specific gravity of zinc is 2.4 times that of aluminum, a component of a new rocket fuse has been redesigned from aluminum bar stock to zinc die casting without changing the ballistic characteristics of the rockets.

This has been accomplished because the die casting process permits placing the metal where it is needed, eliminating it where it is not. Thus, coring of the die cast zinc piece has reduced the volume of the fuse body. The die cast zinc fuse body thereby has the same weight as the aluminum product it replaces, and it has been so constructed that the center of gravity has been changed only .045 from the original body as produced on screw machines.

This interesting redesign has been made by the Monarch Governor Company of Willow Run, Mich., in the production of the M405 Inert Fuse used by the Army Ordnance Corps for its 3.5 inch practice rockets.

Result of the redesign has been a cost reduction of more than 50 percent. Also, production rates are reported to be approximately 50 percent faster.

Machining operations, after trimming flash, are the cutting of two threads. A special machine has been designed to chase the male thread and tap the female thread.

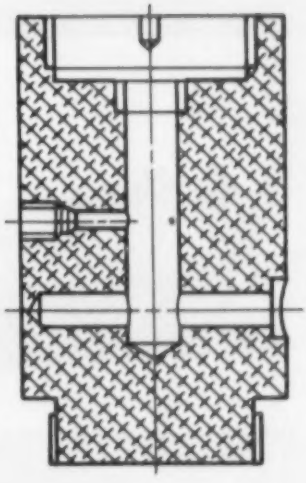


DIE CAST ZINC

Casting comes from die in proper shape and size. There is no inventory problem on raw material.

Axial and cross holes can be cored to depth and diameter. Expansion plugs in place of screws saves tapping.

For finishing, the zinc die castings need only inexpensive dichromate dip coating.



ALUMINUM BAR

Proper size bar stock must be procured, inventoried, cut to length.

All holes had to be drilled and threaded.

Aluminum bar stock required application of expensive anodizing.

VALVE PARTS

continued from page 35

manufacture, the plug was machined from Stellite* slugs and then brazed to the stem of the valve. The design and the method of manufacture of this valve soon showed several faults.

From a design point of view, the rigid connection between the stem and the plug required that the plug rotate with the stem. When the valve was closed or opened the plug had, of necessity, to turn. This turning of the plug produced undue wear on the valve seat and thus shortened the life of the entire valve very materially.

From a manufacturing point of view, the plug had to be machined from a cast slug of Stellite, an expensive operation. Then, when the plug was brazed to the stem, an unreasonably high percentage of the plugs would crack.

Redesign of the valve resulted in a plug that is investment cast by The International Nickel Co. This avoided all machining operations other than a light grind on the plug surface to secure a better finish than could be cast. To overcome the rigid connection between the plug and the stem, the cast plug is now made with a taper on the shank.

The stem is made hollow at its lower end with a sufficiently thin wall of the stem so that after the plug is inserted into the valve stem, the wall of the stem can be spun down around the tapered shank. By allowing some clearance between the ID of the stem and the OD of the plug shank that plug is free to turn and move. Thus, when the valve is closed, the plug seats properly and does not rotate. This has resulted not only in a longer useful life for the valve, but also in a more positive seal with lighter pressure between the plug and the seat.

* Trademark, Union Carbide & Carbon Corp.

ACCURATE Magnesium Die Castings . . . a new note in WURLITZER ORGAN quality

Large two piece magnesium die cast reed holder produced for the Wurlitzer Co.

The change from a heavier metal casting to ACCURATE magnesium die castings reduced weight and production costs for the Wurlitzer Co. Priced competitively with heavier metal castings, these matched magnesium die castings were lighter to handle, machine, and assemble . . . are shock-resistant . . . non-rusting and dimensionally stable. ACCURATE die casting engineers would welcome the opportunity to work with you in adapting magnesium die casting to your product. Write today for recommendations and cost estimates.

Here are a few additional advantages combined in each ACCURATE Magnesium Die Casting:

- Light Weight
- High Strength
- Low Cost
- Fine Surfaces
- Close Tolerance
- Uniformity
- Laboratory Controlled Quality

Major Producer of Aluminum, Zinc and Magnesium Die Castings

ACCURATE DIE CASTING CO.

3089 E. 80th STREET • CLEVELAND 4, OHIO

For more information circle No. 1 on the Reader Service Card

ALLEGHENY LUDLUM PRODUCES HIGH ALLOYS BY CONSUMABLE ELECTRODE

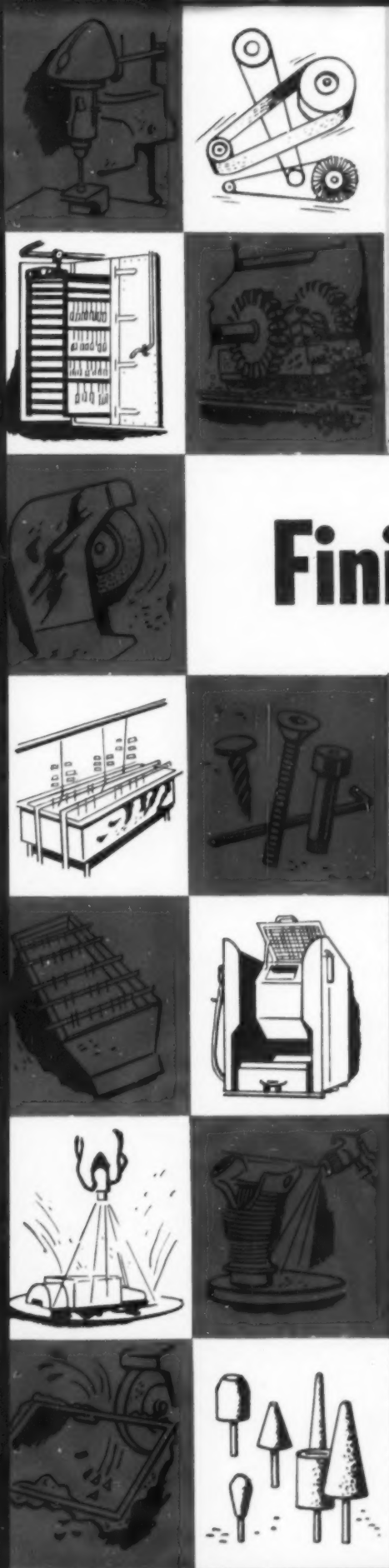
Allegheny Ludlum Steel Corp. announced the opening of a new melting department for the production of high alloy steels that offers 250,000 pounds per month of high performance alloys to the metalworking industry. The company has disclosed the existence of the new consumable electrode vacuum melting facilities.

The company has been a pioneer in the development of valve steels for autos, alloys for aircraft valves, and for the early jet engines made in this country.

At the company's Watervliet High Temperature Laboratory, metallurgists have built up many years experience in consumable electrode vacuum melting.

Discussing the market prospects for consumable electrode vacuum remelted alloys, the company acknowledged that it has anticipated industry's needs in building a department of this size, and expects the market to grow substantially.

As far as the company is able to determine, it can make ten times as much high quality superalloys, or tool steels, or high quality stainless steels in this department that has started operation in Watervliet as the whole industry has been using up to now in any given month.



PMM

Finishing Section

DIE CASTINGS • INVESTMENT CASTINGS • PERMANENT MOLD CASTINGS • PLASTER MOLD CASTINGS • POWDER METAL PARTS • SHELL MOLD CASTINGS

devoted to the specialized problems of finishing . . .

Finishing includes all secondary operations performed on precision metal molded parts — up to and including final surface treatment. This section presents new information about the specialized methods, equipment and materials needed for finish-machining, assembly, surface preparation and final finishing of all precision metal molded parts.

UNICHROME Trade Mark

News about
COATINGS for METALS
Metallic . . . . . Organic . . . . . Decorative . . . . . Protective

More reports of better chromium plating

Here are plants' experiences with deposits from Unichrome SRHS Solutions*

Companies using both SRHS Chromium Solutions and ordinary chromium have had an opportunity to compare results. Substantial differences have been reported.

BETTER COLOR NOTED

One plant of a well known company was using ordinary chromium over an ideal nickel surface. Another of this company's plants wasn't getting the best nickel deposit possible, but still its chromium plating had brightness superior to that of its sister plant. The second plant ascribed the difference to the SRHS Chromium being used in its tanks.

MINIMIZED REJECTS REPORTED

At one company, intricate parts were causing chromium plating difficulties. On occasion, rejects ran as high as 25%. Yet when the SRHS Chromium Solution was used, deposits covered beautifully and work was plated at a reject rate of no more than 0.4%.

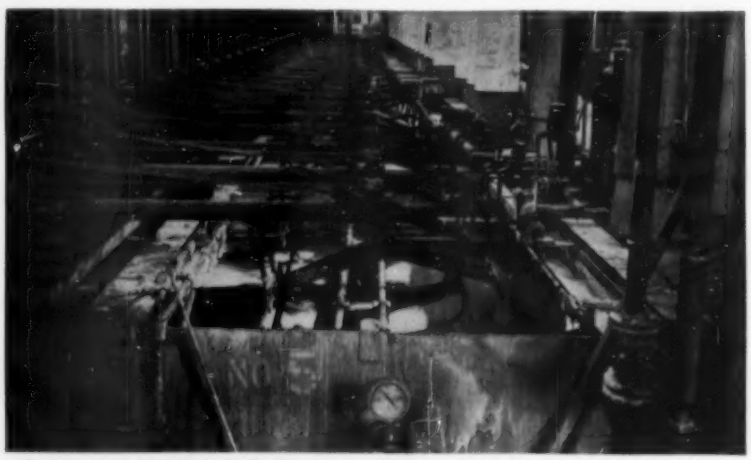
UNUSUAL WEAR RESISTANCE FOUND

A large tool company chromium plated punches used in the manufacture of nuts. Various chromium solutions were tried. They reported that while ordinary chromium doubled the output from punches, deposits from SRHS Chromium tripled it.

All these reported "deposit-advantages" are in addition to the many thoroughly confirmed operating advantages of SRHS Chromium baths. These include plating with higher cathode efficiency, greater speed, a saving in power, and self regulation of important bath constituents.

Platers not using Unichrome SRHS Chromium will find it to their advantage to get the facts by writing United Chromium.

**Trade Mark*



Performance of SRHS Chromium Solutions has resulted in their extensive use by major plating plants.

A complete "package" of processes for chromium finishing

Unichrome Copper, Unichrome Bright Nickel and SRHS Chromium are so thoroughly suited to each other, they represent something unique in finishing. They're the first matched set developed exclusively by one company. Used together, they add up to more advantages than the sum of their individual benefits.

Better Operations and Results

Unichrome Pyrophosphate Copper contains no cyanide, saves disposal costs, and reduces or eliminates much buffing expense.

Unichrome Bright Nickel cuts downtime for purification, has unusual operating stability.

When both of these processes are used along with SRHS Chromium, benefits begin to multiply. The copper proves active for the nickel. In turn, the nickel shows unusual receptivity for the chromium. Passivity problems are eliminated. Downtime drops, rejects become rare.

Moreover, service responsibility rests with one source, assuring prompt technical help and a smooth running operation.

Bulletins supply details on each of the processes. Send for them.

UNITED CHROMIUM DIVISION
METAL & THERMIT CORPORATION
100 East 42nd Street, New York 17, N. Y.
Waterbury 20, Conn. • Detroit 20, Mich.
East Chicago, Ind. • El Segundo, Calif.
In Canada:
Metal & Thermit-United Chromium of Canada, Limited, Toronto 1, Ont.

For more information circle No. 82 on the Reader Service Card

Nowhere is versatility of barrel finishing better exemplified than in manufacture of business machines where thousands of die castings, and other metal components need low cost, precision finishing.

Consistent Barrel Finishing Assured By File System

1. BUSINESS MACHINE parts that are barrel finished by Burroughs range in size from minute pins to the large aluminum die cast base that can be seen in the background, top photo. Each of the 25,000 cards in the file, below, represents the precise barrel finishing cycle of an individual part. Assistant foreman, Alex McCreadie, is shown checking the file on a finishing cycle.

EVIDENCE for barrel finishing's great versatility and remarkably uniform results is in abundance at the Burroughs Corp., Detroit, where hundreds of thousands of parts of business machines are wet processed every day.

Consider for a minute over 25,000 different parts that are integral to the workings of the adding machines, calculators, accounting machines, electronic "brains" and defense items Burroughs manufactures:

Parts, such as pictured in Figure 1, range in size from almost infinitesimal to rather large castings; they are machined, ground, stamped and die cast from steel and aluminum. As few as six and as many as a thousand parts are barrel finished in one barrel. On many parts tolerance limits are set at .0025, so finishing is very closely controlled. Precision control is essential because the lightning-like speed of the interacting parts in the finished machines demand that all edges are well rounded and surfaces perfectly smooth.

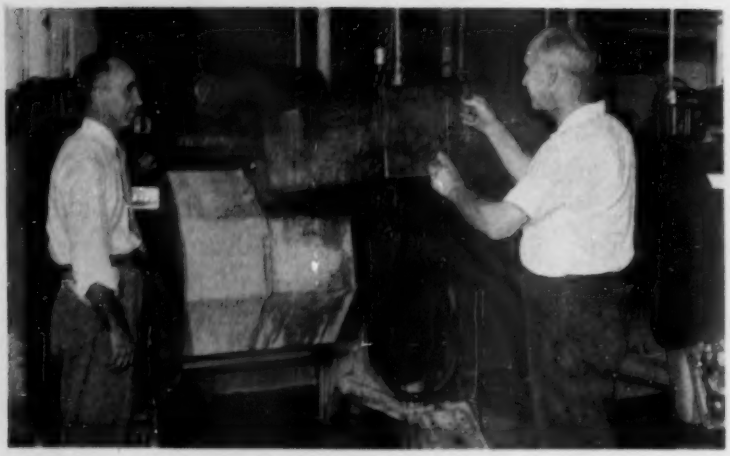
To get the versatility required to meet these important conditions, Burroughs began replacing constant-speed, hand fed tumbling machines with Almco Supersheen finishing barrels in 1951. To simplify processing, an index system was developed to codify the barrel finishing information necessary to produce uniform results load after load of the many different parts.

A code number for each part is recorded on a file card; also included is all pertinent processing instructions; barrel rpm, type and amount of media, type and amount of compound, water level, time cycle and number of parts per loading.

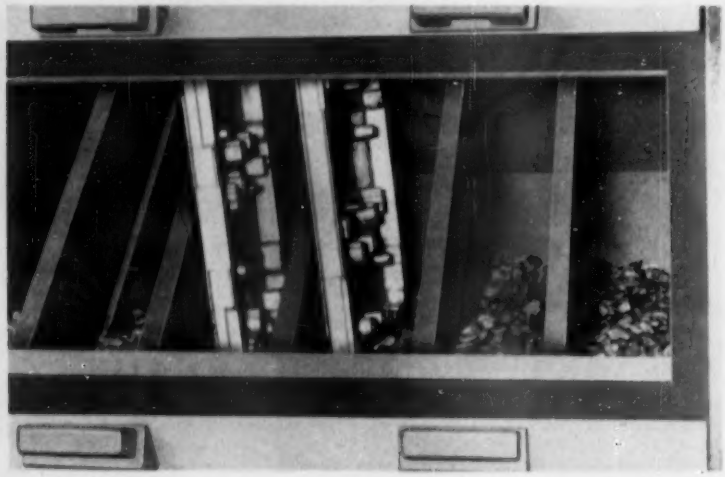
As an example, the index card for a typical part reads: JB-21; 6 rpm; 2½ hours; 300 lbs. moldwash; 200 lbs. aluminum oxide chips; 4 lbs. tri-sodium phosphate with water level two inches above load height, and 15 parts per compartment. This card is placed with parts as they enter the barrel finishing department and remains until processing has been completed; then it is returned to the file for use later. In this way, absolute control is exercised over all the finishing variables.

For finishing most parts, barrel is loaded slightly more than 50 percent with abrasive chips or combination of abrasive chips and parts; it is at this load height that most abrading action is obtained because of greater diameter and length of slide. The specified amount of water and compound

Continued on next page



2. VARIABLE SPEED BARREL is shown being loaded with hoist pan and chain. Pan is lowered to the floor and a separator unit is put over it to separate parts from media after completion of barrel finishing.



3. SIX DIE CASTINGS are processed simultaneously in this multiple compartment Almco barrel. Castings are kept separated to avoid impingement or peening action.

BARREL FINISHING (continued)

is then introduced, according to the type of finish required.

As mentioned, one of the prime requirements in finishing intricate parts for business machines is well rounded edges. Two features of modern barrel finishing equipment help do this job to perfection: The vari-speed drive which controls the exact rpm at which parts and media mass are moved, and the sliding action of the mass in the barrel which produces deburring and polishing of the parts at a uniform rate. Burroughs engineers say such precision finishing was not really possible with the constant-speed equipment previously used. Also, with the new equipment production capacity was increased 80 percent and required floorspace was actually 30 percent less.

Where parts and media had to be hand fed, Burroughs now employs Almco semi-automatic handling equipment as seen in Figure 2. Media and parts are hoisted by pan into barrel after being drawn from hoppers. When the time cycle has been completed, the barrel is flushed and parts and media are dumped to a portable screening unit where the abrasive chips fall through to pan for re-use. Parts are then ready for drying.

Three types are used: Large parts are dried by air pressure hose; smaller parts are dry tumbled with absorbent materials, and some parts are centrifugally dried. Parts are then ready for the next stage in manufacturing. Those that require heat treating will return to the finishing department where they are barreled to remove discoloration.

While cost savings are routine with modern barrel finishing equipment as compared with hand deburring and other mechanical methods, generally, the longer the time cycle, the greater the savings. One type of adding machine part requires 11 hours to get the desired smooth edges. In the prescribed number, it is loaded into a barrel towards the end of the first shift. An automatic timer is preset to shut off the unit after 11-hr. time cycle is completed. It is then run unattended through the second shift and then unloaded when the first shift crew returns.

53 Barrels In Operation At Two Plants

Burroughs uses 36 different abrasive media, including bonded aluminum oxide chips of different sizes, steel cones, balls, stars and hardened scrap metal. The metal media speeds up grinding and polishing action when used with abrasive compound. Various compounds are required; where one will enhance grinding action, another will promote the proper color of the finished part. All compounds perform the important functions of lubricating the mass and keep media and parts clean.

With production requirements increasing every year, Burroughs has added new Supersheen barrels; presently 33 are in operation at the Detroit plant and 20 at the Plymouth plant. The unit in Figure 3 is a compartment type barrel at the Plymouth plant which is used to deburr and polish large die cast aluminum base plates. This barrel is designed to hold the parts stationary while media is allowed to flow around them; this arrangement provides more abrading action than with free moving parts, but the important reason for it is to prevent impingement and peening action of one part on another. A feature of this

barrel is the reversing of barrel direction at fixed intervals, thus assuring the proper action on all part surfaces.

On this particular part, Burroughs has increased production from two per hour by hand deburring to six per hour with multi-compartment finishing, a 300 percent increase. If production warrants, in many cases still greater increases can be obtained by fixture-type barrels.

Different size and model barrels were required to provide the maximum flexibility for barrel finishing requirements at Burroughs. Barrels used include 16 and 30 ID with 8, 30 and 40 in. widths. All are neoprene lined to cushion loads and prevent wear on the metal drums and provide better coloring of burnish finishes. Of the original barrels installed, all have provided continuous service without any replacement parts or downtime—except occasional relining of drum.

HOUGHTON MANAGER DIES

James McElgin, manager of the Metal-Working Department of E. F. Houghton & Co., Philadelphia, died suddenly while on business in Chicago on December 7.

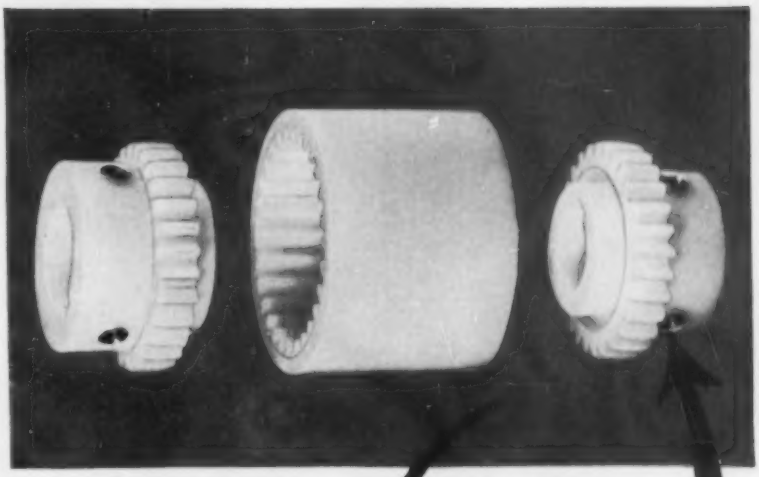
Mr. McElgin, who was 54, had been employed by Houghton since 1924. He was a chemical engineering graduate of Brooklyn Polytechnic Institute and took graduate work at Temple University in metallurgical engineering.

He was a 25-year member of the American Society for Metals, and served on a War Production Board Committee on Heat Treatment of High Speed Steels. He also held membership in the American Ordnance Association and American Foundrymen's Society.

FORM NEW DIVISION

The formation of the Ross Heat Exchanger Division of American Radiator & Standard Sanitary Corporation with headquarters in Buffalo has been announced by Joseph A. Grazier, president of American-Standard.

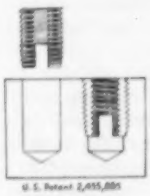
The new division will conduct the operations in the heat exchanger field formerly carried on by Kewanee-Ross Corporation, including the operation of the plant at 1407 West Avenue in Buffalo. Kewanee-Ross is being dissolved in accordance with the policy of divisionalizing American-Standard activities along major product lines.



TAP-LOK® INSERTS prevent failure of vital threads in soft materials

Each of the two male gear segments of this nylon gear coupling is locked to the shaft by means of three set screws 120° apart. Threads holding down these set screws must stand up under torque applied by an Allen wrench. To prevent shearing of the nylon threads and to allow adequate torque application on the set screws, Tap-Lok Inserts are installed at these vital points.

Tap-Lok Inserts are internally and externally threaded bushings of steel or brass which increase thread strength in plastics, light metals and similar structural materials. Their unique self-tapping feature substantially reduces assembly costs by eliminating separate tapping operations, hole preparation, secondary staking.



U. S. Patent 2,455,885

Used extensively as original equipment, Tap-Lok Inserts are also ideal for salvage and repair of stripped threads.

WRITE FOR DESCRIPTIVE FOLDER

Also manufacturers of Groov-Pins for positive locking press fit.

GROOV-PIN CORPORATION

1122 Hendricks Causeway Ridgefield, New Jersey

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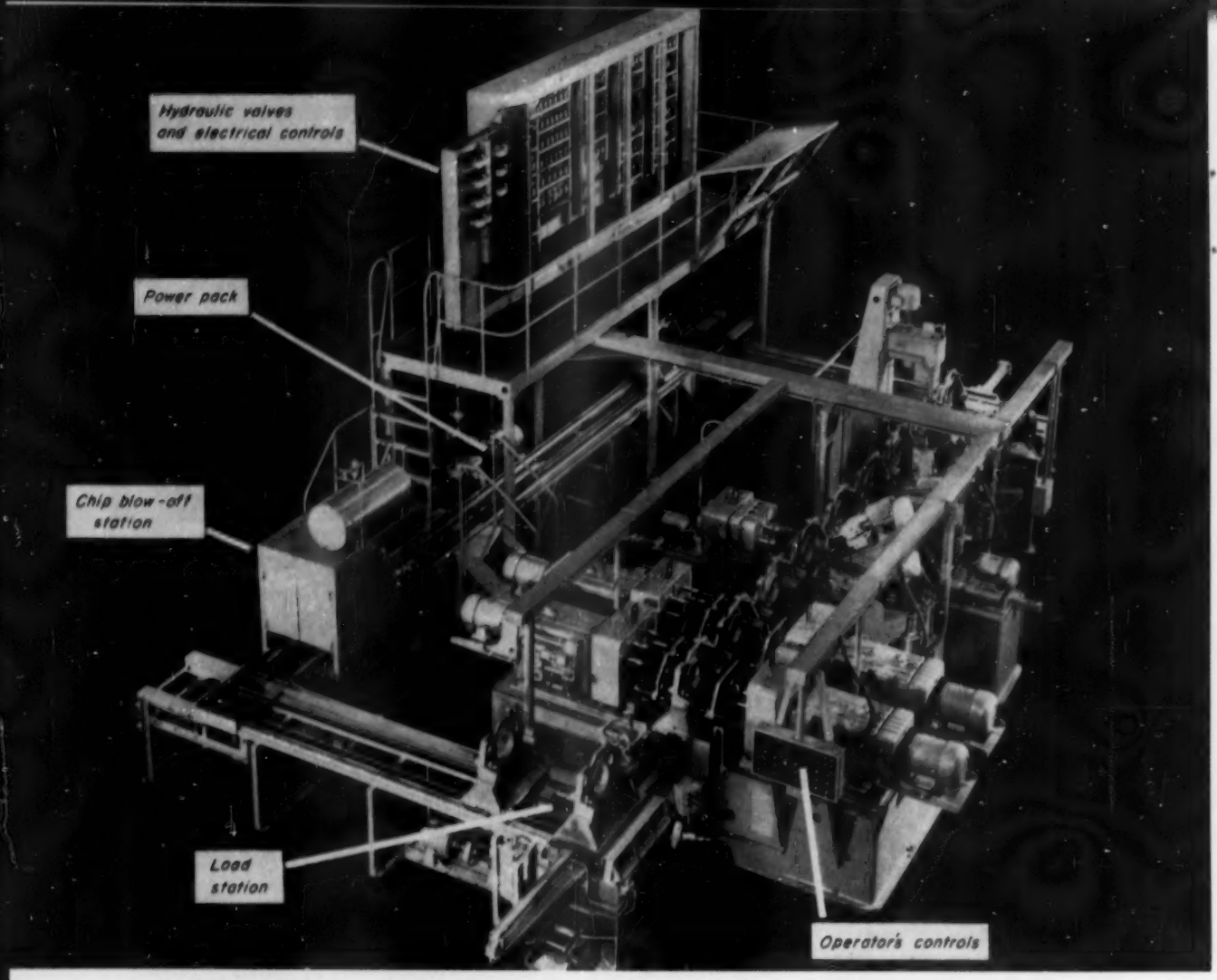


THIS TWELVE-STATION machine can perform 92 operations per minute on a die cast aluminum torque converter housing.

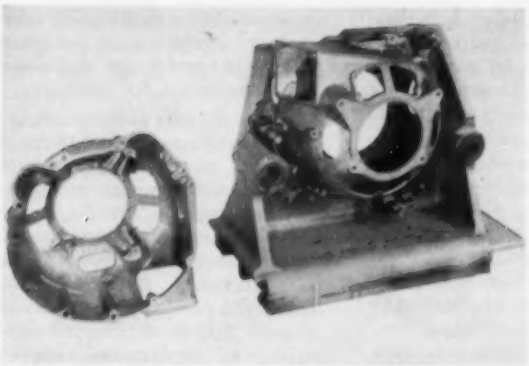
Plan Your Automatic Transfer Machine

WITH more and more die castings being machined on high production, automatic transfer machines, the question of planning and building units of this type has become a frequent concern of production engineering departments.

It is possible to design virtually an entire transfer unit for operations such as drilling, tapping, milling or broaching die castings using standard components, meeting the needs of today's automatic plant operation at minimum cost.

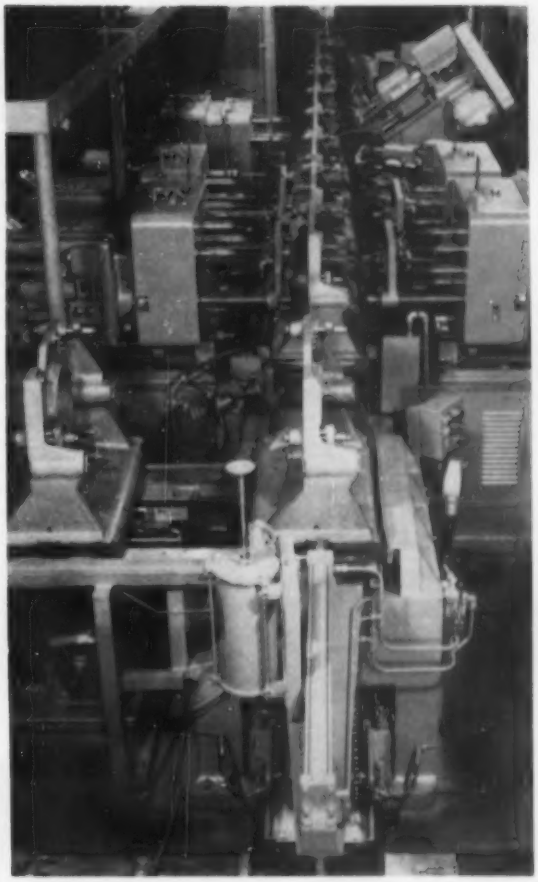
Here's the way one production engineering company in Canada has solved the design problems connected with a 12-station transfer machine for machining die cast aluminum torque converter housings. This machine, installed in an auto plant by Modern Tool Works, Ltd., of Toronto, is capable of performing 5520 operations per hour. How did they work out the design . . . ?

1. It all starts with the initial discussion with the customer to learn what operations must be performed. In this case, the housing requires 34 drilled holes, two of which also need reaming, ten tapping.
2. Process and planning department determines the number of operations that are practical to be grouped, planning horsepower and thrust requirements for each individual group. On this job, 12 work stations, each a standard, hydraulically-fed multi-spindle unit, are used.
3. After selecting individual machines and arranging them in proper order, a proposal drawing is made to scale. Sequence of operations is listed along with estimated production capacity and notes on required work handling devices.
4. Capacity of the hydraulic transfer system and cylinder sizes are determined based on the required transfer time.
5. An estimator analyzes the entire project to come up with a



TORQUE CONVERTER HOUSING is located in the pallet-type fixture, above right, against a machined face. Pins in the fixture locate into two cored holes. Once the part is loaded and clamped by the operator, the part "rides" through the 12 working stations on an automatically controlled cycle.

LOADING AND UNLOADING are the only operations performed by hand, with operator's control panel for the entire machine close-by.



DOWN THE MAIN LINE of the transfer machine, the palletized die casting moves for a succession of drilling, reaming and tapping.

With Standard Components

price which, along with a detailed description of the machine, goes to the customer.

6. Now there is a dwell to permit customer action.

7. With the order placed, the proposal drawing and quotation is given to the designer who makes a rough layout to double check the proposal.

8. Now the design begins . . . particular makes, models and sizes of hydraulic equipment are chosen. To develop the circuit, the designer works with the chief draftsman, electric circuit designer and, in some cases, with a representative of the hydraulic component suppliers.

9. With the circuit completed and line sizes established, physical location of the lines and valves is decided. On the 12-station machine, all valves are in a single cabinet beside the electrical control cabinet upon the mezzanine out of the way. This location saves floor space and puts the solenoids of various valves as close as possible to their respective electrical control equipment.

The power package is located on the floor because of its great weight and to be as accessible as possible for daily topping up of the reservoir. Hydraulic lines are suspended below the overhead electrical ducts out of the way, yet accessible for service. Overhead lines are also less liable to be damaged. Unions are provided at various points to permit ease of replacement and alteration.

The final design provides flexibility to accommodate future component changes or retooling to suit a different workpiece. Through the use of standardized elements, additional work stations may easily be added to extend the useful life of the basic machine.

This approach will reduce the special content of such machines to a point where the tooling will be the only special portion, resulting in better, more useful machines at a lower price.

DELIVERY SCHEDULING
continued from page 44

duck-soup to build compared to large, intricate, carburetor dies; small nameplate dies are best built by one man, while several die makers may efficiently work simultaneously on complex dies.

This explains to a certain extent why it is so difficult to speed up die making merely by adding more men than were planned in the original cost estimation. Actually, the die caster can't speed up the delivery of a die just by instructing his die shop foreman to add more men. Most good die makers are already working nine hours per day; they do not want more overtime. Nor does the responsible die maker want another man working on his die during the swing or graveyard shifts — too often the "second" boss makes mistakes for which the responsible die maker gets blamed.

About all the overtime any die caster can reasonably accept from his customer is 10-15 percent (unless the die makers are willing to work seven days a week).

Once in a while the die maker may feel that the die blocks ought to be stress relieved after the cavities have been roughed out. When this becomes necessary, work is held up a minimum of 3-4 days while the die blocks are sent to the heat treating concern.

Once the die has been completed in the die shop to the point where its performance must be tested, the die is turned over to the casting department for trial.

Here, the die's functioning is observed, Figure 2, and if the die is found to produce satisfactory castings with respect to appearance and internal structure, it is approved except for dimensions, which are checked by a dimensional inspector. If the dimensions check out perfectly, the die is approved for hardening, which is done after the customer's approval of the sample part.

Between the trial run and production operation, 5 to 8 days may elapse, depending upon the size, complexity, and intricacy of the part. Small uncomplicated parts cast in simple dies can be tested and inspected quickly. Large and complex dies usually require a long trial run period; and it is not uncommon for a very large and intricate carburetor part to require three to four days to inspect.

Frequently a complex die will require many hours of re-work after its trial run before producing sound, acceptable die castings. This sort of die re-work is in addition to that necessitated because of incorrect dimensions.

Unfortunately, some buyers believe that once the die is made, all die casting department has to do is run it; nothing could be further from the truth!

It is customary for the die caster who is to supply cast and trimmed parts only to send one of the first acceptable castings from an appearance standpoint to the customer for inspection.

If this die casting is not dimensionally like the part print, the customer sends the die caster an inspection report asking that one or all of the defects his inspectors have discovered be corrected (sometimes the customer will accept certain non-critical dimensional deviations in the prescribed dimensions for the part). The delivery of the production parts may be hastened by the customer if he does not require the die caster to correct every dimensional defect.

Making all corrections may be very time consuming and non-critical dimensional defects should be approved when possible. Naturally, if they are critical, the customer has no alternative but to instruct the die caster to effect the necessary alterations.

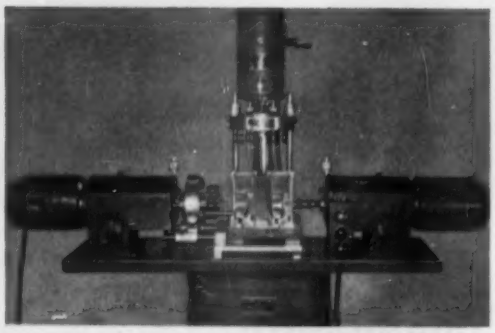
Following the making of corrections on the inspection report, an-

ETTCO-EMRICK
Lead Screw Tapping Equipment

ALL-ELECTRIC operation and control... for the fastest, most accurate tapping yet!

No reversing motor needed — electro-magnetic clutches do the work

This exclusive feature provides a speed, sensitivity and precision unequalled by any other tapping method or device. It eliminates the need for a reversing motor, cams, air and hydraulic systems. You get these advantages in both single and multiple spindle operation because Ettco-Emrick Lead Screw Tapping Equipment can be used as single spindle units or with Ettco-Emrick Multiple Spindle Heads. The equipment is furnished: (1) as individual units; (2) as standard upright machines; or (3) as special machines built either by us or by you to your requirements.



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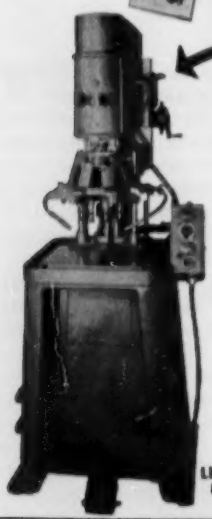
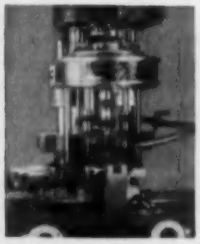
LEAD SCREW UNIT

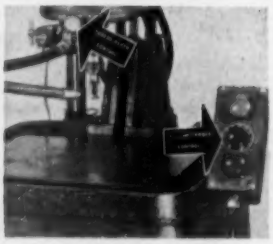
BASIC LEAD SCREW UNITS when combined with standard Lead Screw Machines and Ettco-Emrick Multiple Heads and workholding fixtures give the advantages of high speed, precision "specials." Standardized Ettco components make this tooling practical and inexpensive.



LEAD SCREW MACHINE



MULTIPLE HEADS and workholders are "Unit-Engineered" to insure fastest loading, positioning, tapping and ejection.



Clutch torque can be regulated to meet tapping conditions. Thread depth can be controlled to within ¼ turn of tap.

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TAPPING ATTACHMENTS • MULTIPLE HEADS • TAPPING MACHINES • INDEXING FIXTURES • TAP AND DRILL CHUCKS

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other sample may have to be sent to the customer. If not, the die caster has the die hardened and prepared for production at once. Hardening may take from 3 to 5 days, depending upon the size and complexity of the die.

As soon as the die is returned from the heat treater, it is assembled (it is heat treated disassembled) and then the cavity faces are polished in order to remove any traces of heat treating scale. Scale removal and die polishing may take 1 to 15 days.

Upon approval of the sample, the die caster completes the mechanical trim die or dies which have been previously readied, awaiting an approval sample before completion.

Depending upon the complexity of the part, its shape and size, and whether it has cored openings in its face or sides which must be trimmed of flash, the trim die will be either a push-through type, a compound or pad type — or perhaps an even more complex type. The simpler the trim die, the shorter the period of time required between sample approval and the production operation. Obviously a single cavity trim die of the push-through type for a circular casting takes less time to get ready than a multiple cavity pad type trim die designed to trim two or more dissimilar, irregularity shaped die castings at once.

Indeed, preparing the former may be only a matter of hours as against a 10-14 days for the latter type (assuming of course all of the preliminary work has been accomplished before the samples were approved) the die caster then needs only to machine the cutting edges of the die to conform with the contours of part.

In trim dies for script nameplates, the machining of the cutting edges of the trim is quite a project and takes several days.

Occasionally, parts are of such a configuration that they must be trimmed first in one die and then in another; this is frequently true of pump or carburetor components in which flash must be removed not only from the outer edge of the part but also from the insides of all the cored holes.

In the case of parts which are to be furnished cast and trimmed only, the completion of the trim die signals the beginning of the production for the customer by the die caster; however, for parts that also require machining, production cannot begin until the machining jigs and fixtures have been completed. Where these are required, the die caster gets them

DIE CASTING DIE LOG

File No.:_____ Date:_____

Part Number:_____ Die Number:_____

Project Number:____ Blueprint Number:_____

Die Casting Machine No.:____ Operator:_____

Alloy:_____ Metal Grade:____

Testing Directed by:_____

1. Metal Temperature in the Pot, °F.:_____
2. Die Temperature, cold half, °F.:_____
3. Die Temperature, hot half, °F.:_____
4. Pressure, psi.:_____
5. Plunger speed, ft/min.:_____
6. Locking pressure, psi.:_____
7. Length of the Butt, Inc.:_____
8. Number of seconds between injection & opening the die:_____
9. Die Lubrication, where used:_____
10. Die Lubrication, type:_____
11. Die Lubrication, frequency of application:_____
12. Plunger dia., in.:_____
13. Plunger lubricant:_____
14. Water cooling:_____
15. Source of heat on die:_____
16. Number of shots per minute:_____
17. Number of shots per hour:_____
18. Ladle size in. in diameter:_____
19. For every ____ shots, ____ ingots, ____ lbs., have to be added to the furnace.
20. Remarks and notes for future run:_____

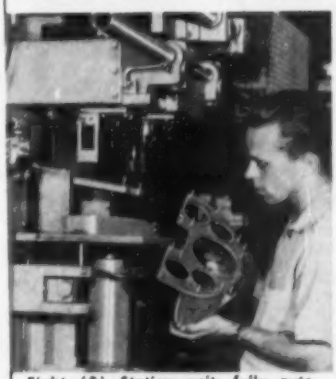
Approved by:_____

2. TRIAL RUN of the die is checked with a log like this one.

IT'S HERE!

MULTIPLE SPINDLE AUTOMATIC HOPPER FED STUD DRIVER

Two (2) Station hopper-fed unit positioning and driving studs automatically into a die cast part.



Eight (8) Station unit, fully automatic, driving studs into cored holes in a complicated die cast part.

LOOK AT THESE FEATURES

- FULLY AUTOMATIC
- TAPS AS IT DRIVES
- ASSURES UNIFORM DEPTH
- ELIMINATES TAPPING
- Adaptable to Automatic Tapping

It's one of the currently greatest strides in assembly AUTOMATION . . . AVAILABLE NOW . . . and in multiple station units . . . fully automatic and hopper fed to produce faster and with all the precision you'll ever require. Write today for our 4 page editorial reprint. It describes completely the machine's ability and function.

DIE CASTERS

NOW YOU CAN DRIVE STUDS AUTOMATICALLY!

STUDRIVE, INC.
2704 E. LARNED STREET
DETROIT, MICHIGAN

For precision cleaning of molds and dies—

NEW PANGBORN HYDRO-FINISH

gives you: Fewer moving parts—Easier handling—Added efficiency

Now Pangborn's famous Hydro-Finish is yours with added convenience and efficiency! Holding fine tolerances, Hydro-Finish cleans molds and dies in minutes... offers many new advantages. Pangborn has done away with the pump; air jet sluriators now keep the abrasive in suspension. This means a lower investment and fewer moving parts. Optional loading stand simplifies handling, washing and inhibitor application. The cabinet has been redesigned for more efficient operation. These and other advantages make the Pangborn Hydro-Finish ideal for precision cleaning and finishing!

For further details on Hydro-Finish, send for Bulletin 1403 now! Write: PANGBORN CORP., 3500 Pangborn Blvd., Hagerstown, Md.

Pangborn

BLAST CLEANS CHEAPER

Circle No. 80 on the Reader Service Card

designed and almost completed before the first parts come off the die casting die. Then, as soon as parts are die cast and dimensionally inspected by the die caster, the machining jigs and fixtures are completed with the aid of the parts themselves.

Getting these machining jigs and fixtures into working condition takes time and consequently the die caster cannot be expected to furnish finished machined samples to the customer the same day he gets his die casting die working. A period of 7-10 days may be required if the machining to be done with the aid of the jigs and fixture is very precise and extensive.

If a part is also to be polished, buffed, plated, and painted after it has been machined, the die caster must also make preparations for the necessary polishing and buffing fixtures, plating racks, and spray masks. Sometimes the die caster makes wooden patterns of the die cast part early in the game so that the polishing and buffing, plating, and painting foremen can prepare in advance.

Likewise, the effectiveness of proposed plating racks cannot be tested until parts are actually available. Even if the pre-designed racks prove acceptable, it takes time to make enough of them to enable the die caster to plate on a production basis.

Nor can the preparation of spray masks be done in advance of the receipt actual parts from the die. Because spray masks must be formed directly from the actual die cast part and never from wooden patterns. A matter of a week is usually necessary to complete a simple spray mask and put it into operation on a production basis.

ALLIED RESEARCH EXPANDS FACILITIES

Allied Research Products, Inc., Baltimore manufacturer of the Iridite line of chromate conversion finishes and ARP process chemicals, has just completed a plant expansion that doubles the area available for research and development facilities. The new quarters consist of an addition to the structure located at 4004 E. Monument Street, Baltimore. addition to providing approximately twice the area available in the old building, allowance has been made for approximately a fifty percent future expansion.

Meet the abbot

Here's a little man you'll surely want to know. Philosopher and physicist, mathematician and mechanic, designer and doodler, dreamer and detective — these are a few of the intriguing facets which make up the engaging personality of *the abbot.*

Space doesn't permit us to tell you all about him here. Suffice it to say he's a dedicated soul (he professes no specific creed or faith) who has devoted his life to a study of "Barrel Finishing — with Steel Balls and Shapes" . . . particularly our own tumbling barrels and tumbling materials.

We think you'll want to read the fascinating case histories which he will present in this space in the months ahead, but first, we'd like to send you a more detailed explanation of his background and how he came to select his favorite study subject. So, just drop us a line and we'll send you a formal introduction to . . . *the abbot.*

THE ABBOTT BALL COMPANY
1084 NEW BRITAIN AVENUE
HARTFORD 10, CONN.

ABBOTT

For more information circle No. 71 on the Reader Service Card

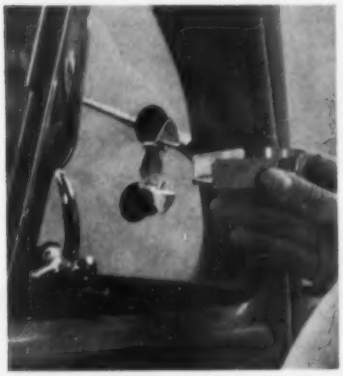
LETTERS
continued from page 33

NEW AUTO ACCESSORY

Attached please find photographs of a Vent Window Ash Tray, which I have developed.

I am now building die cast dies for this part and they should be completed in about three to five weeks and will forward a sample at that time if you are interested.

I might add that the small suction cups hold the clip very well and as you can see from the snapshots, the ashtray can easily be removed from its holding device to be emptied, or the vent window can be opened and the contents are sucked out the back of the ash tray by the air flow.



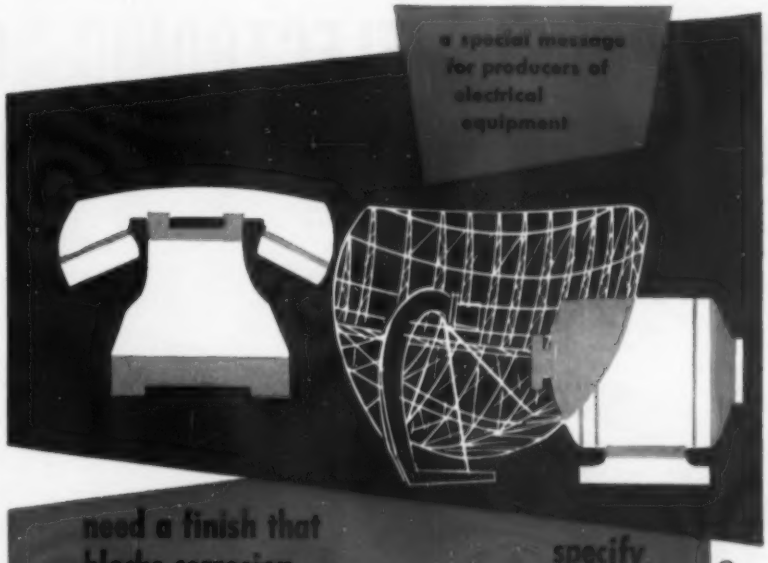
The item will be die cast and finished with copper, nickel and chrome; it is also designed so it can be mounted on any Vent Window of an automobile.

The information I am concerned with at present is this, How do I get in touch with a Manufacturers Representative or a sales contact for an item of this type? Any assistance will be greatly appreciated.—F. C. H.

While we are not able to put this reader in touch with a sales outlet, we are publishing a picture of his device. We will be glad to put readers in touch with F. C. H.—Ed.

MILNE OPENS WAREHOUSE

A. Milne & Company, New York, N. Y., nationwide distributors specializing in solid and hollow tool steels, announce the opening of a tool steel warehouse in Detroit, Michigan. W. Ted Nagorsen has been named manager in charge. The new warehouse, is located at 4820 Wabash Ave.



need a finish that blocks corrosion, maintains conductivity? specify IRIDITE®

Here's peak corrosion protection combined with conductivity, weldability and solderability. Here's a finish that holds paint firmly, prevents underfilm corrosion. Here's a line of attractive final finishes to add quality and sales-appeal. Here's Iridite . . . and here's how you can use it:

ON ZINC AND CADMIUM you can get highly corrosion resistant finishes to meet any military or civilian specifications and ranging in appearance from olive drab through sparkling bright and dyed colors.

ON COPPER . . . Iridite brightens copper, keeps it tarnish-free; also lets you drastically cut the cost of copper-chrome plating by reducing the need for buffing.

ON ALUMINUM Iridite gives you a choice of natural aluminum, a golden yellow or dye colored finishes. No special racks. No high temperatures. No long immersion. Process in bulk.

ON MAGNESIUM Iridite provides a highly protective film in deepening shades of brown. No boiling, elaborate cleaning or long immersions.

AND IRIDITE IS EASY TO APPLY. Goes on at room temperature by dip, brush or spray. No electrolysis. No special equipment. No exhausts. No specially trained operators. Single dip for basic coatings. Double dip for dye colors. The protective Iridite coating is not a superimposed film, cannot flake, chip or peel.

WANT TO KNOW MORE? We'll gladly treat samples or send you complete data. Write direct or call in your Iridite Field Engineer. He's listed under "Plating Supplies" in your classified telephone book.

Iridite is approved under government specifications

ALLIED RESEARCH PRODUCTS
INCORPORATED
4004-06 E. MONUMENT STREET • BALTIMORE 5, MD.

For more information circle No. 72 on the Reader Service Card

BURROUGHS ELECTRONIC "BRAIN" PARTS GET A Ph.D.* FROM SUPERSHEEN METHOD

*POLISHING - HONING - DEBURRING

SUPERSHEEN BARRELS REDUCE FINISHING TIME 30 PERCENT ON MORE THAN 25,000 DIFFERENT PARTS FOR BURROUGHS MACHINES

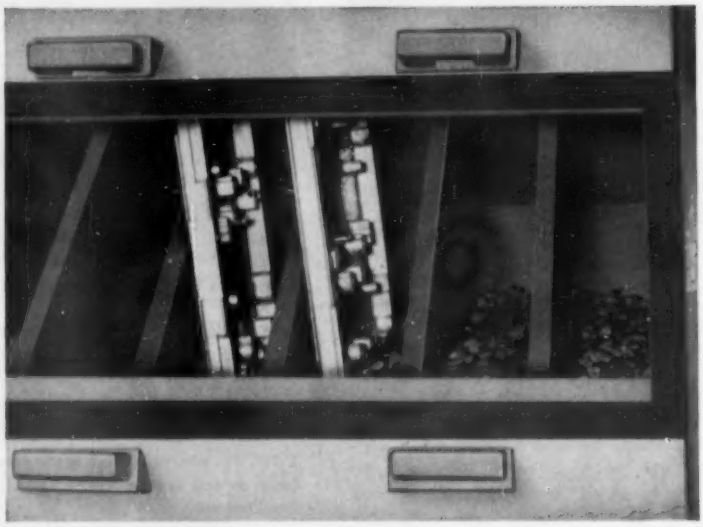
One of the clearest demonstrations of ALMCO SUPERSHEEN Barrel Speed Finishing's versatility can be seen any day at the Burroughs Corporation, one of the world's largest manufacturers of business machines. Here daily hundreds of thousands of parts are precision finished, many to tolerance limits of .0005. The sliding action of the parts and abrasive media and compound solutions produce the well-rounded edges and microinch surfaces so necessary to the perfect operation of these intricately designed machines.

A prime example is the thousands of barrel finished parts that go into the Burroughs E-101 electronic digital computer, the first desk-size "brain" ever manufactured. It solves tough engineering, research and business problems almost with the speed of light! And such speed demands absolutely uniform surfaces on all moving parts—polished, honed and deburred under rigid control.

FLEXIBILITY OF OPERATION

Yet with over 25,000 *different* parts to be barrel finished, ALMCO barrels provide Burroughs with the flexibility so vital to precision finishing. Of special value is the variable speed drive which permits the exact barrel rpm required on any given lond of parts; this control produces uniform, mass production of parts of all sizes.

Another time and money saving feature is the automatic timer for barrel finishing parts with long time cycles. At Burroughs, these parts are loaded near the end of the first shift and run unattended for 11½ hours—then automatically stopped by pre-set timers. The first shift then completes final processing.



PRODUCTION INCREASED 300% ON FINISHING LARGE CASTINGS

Production has increased 300 percent at Burroughs on large parts with this multi-compartment type ALMCO barrel you see above. Large parts like these must be kept separate while being speed finished to prevent impingement or peening. Now six large castings can be deburred and honed per hour as compared to the previous hand operation which finished only two in the same time.

With higher production requirements, fixture-type barrels may be used to greatly increase finished output. By properly engineering processes and fixtures, extremely intricate and large parts can be barrel finished at exceptional cost savings.

BARRELS PROVIDE CONTINUOUS OPERATION WITHOUT DOWN TIME

For this modern department, ALMCO engineers helped Burroughs select various size barrels to provide maximum speed finishing versatility.

These ALMCO Speed Finishing Barrels have provided continuous service without replacement parts or down time since installed in 1951 with exception of occasional barrel relining.

You're assured of the same rugged performance because ALMCO Barrels are constructed of heavy gauge cold rolled steel, rigidly gusseted with ¼" x 1½" flat steel. Extra cabinet strength is provided by the "A" frame plus box frame construction. All frame and supporting members are heavy plates and U channel iron.

Other important construction and design features are: neoprene barrel lining to cushion work parts, improve color and prevent wear on the barrel; magnetic brake with toggle switch for ease of positioning barrel when loading and unloading, and quick-opening and closing cam-type door. Extra heavy chain, sprockets and heavy duty bearings increase service and performance over similar units.

80% MORE PRODUCTION CAPACITY IN 20% LESS FLOOR SPACE

Here's a look at Burroughs' Detroit barrel finishing department. Prior to the installation of 24 ALMCO barrels in 1951, 36 constant speed, hand-fed tumbling machines were used. The change brought a production capacity increase of 80 percent, yet required 20 percent less floor space. And ALMCO semi-automatic handling equipment has helped effect important time savings in the loading and unloading of parts and media.

As the department expanded, new ALMCO units were added; presently, there are 53 operating at the Detroit and Plymouth plants.

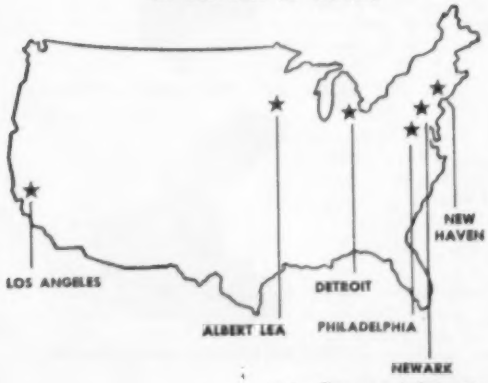
This modern operation at Burroughs speed finishes mill cut, ground, metal stamped and die cast parts, ranging in size from tiny accounting machine pins to large base castings for business machines. To meet exact requirements, finishing information on each of the more than 25,000 different parts is indexed on separate file cards.

These cards specify the time cycles, rpm's, water levels, media and compounds necessary to obtain the proper abrasive and lubricating action. Here, various SUPERSHEEN compounds and media help obtain the precise deburring, honing or coloring of parts.

FREE 52-PAGE CATALOG SHOWS YOU ALL THE FACTS ON COST-SAVING, TIME-SAVING BARREL FINISHING WITH SUPERSHEEN METHOD

This comprehensive catalog is yours for the asking. Packed with facts and photos on America's finest and most complete line of barrel speed finishing equipment. Write: Almco, 412 Marshall Street, Albert Lea, Minn.

ALMCO FINISHING LABORATORIES AND ENGINEERS ON YOUR PROBLEM IN MATTER OF HOURS



ALMCO Sales Engineers specialize only in barrel finishing equipment and materials; this means expert service for your special problems. Branch offices are convenient to most metal finishing centers; thus you can bring in sample parts, see them processed and observe how the SUPERSHEEN METHOD can save you time and money.

ALMCO SUPERSHEEN METHOD FOR SPEED FINISHING

Division of Queen Stove Works, Inc.

ALBERT LEA, MINN.

For more information circle No. 73 on the Reader Service Card

25% FASTER TUMBLING

Equipment and materials combined to increase direct-labor savings over other tumbling methods!

with

TUMBLE GRAV-I-FLO FINISH

25% More Volume in 30% Less Floor Space!

MODEL 48"
Two Compartments

than comparable machines.

Grav-i-Flo's larger capacity plus improved cutting and finishing materials slash processing time—no need for transferring parts from cylinder between roughing and finishing. Get speed *and* smoother surface, higher lustre by asking for a Grav-i-Flo representative to visit your plant, or by sending us samples.

SEND FOR CATALOG showing complete line of Grav-i-Flo equipment, accessories and supplies.

Grav-i-Flo Corp. Dept. PMM-1, Sturgis, Mich.
☐ Send complete catalog. ☐ Have Sales Engineer Call.
☐ We are sending samples.

Company _____

Name _____ Position _____

City _____ State _____

GRAV-I-FLO CORPORATION, 400 Norwood Avenue, Sturgis, Michigan

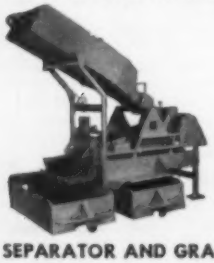
COMPLETE EQUIPMENT, ACCESSORIES AND SUPPLIES

MODEL 66"—TWO COMPARTMENTS

MODEL 36"—TWO COMPARTMENTS

MODEL 32"—TWO COMPARTMENTS

MODEL 24"—TWO COMPARTMENTS



CHIP SEPARATOR AND GRADER

For more information circle No. 75 on the Reader Service Card

USEFUL LITERATURE CATALOGS, MANUALS

to get any of the free materials described here, circle the appropriate number on the reader service cards bound into this issue

PROCESSES

Powdered Brass Compacts: 154
A new technical bulletin has been prepared by Dixon Sintaloy, Inc. giving the composition, density, tensile strength and elongation for a series of nine different brasses made from metal powders. In addition to the physical and mechanical data presented some suggested applications of the different compositions are given.

Stainless Steel Castings: 155
A new 29 page data book has been released by Allegheny Ludlum Steel Corp. on corrosion and heat resisting castings in Allegheny Metal. The chemistry, physical and mechanical properties of the cast metals are given together with examples of typical large and small castings and recommended uses.

Powder Metallurgy Hand Book: 156
The Keystone Carbon Co. has published an 18 page book on powder metallurgy. Included are sections on the process, designing for powder metallurgy, typical physical properties of powder metal compacts, and a description of the facilities of the company.

MATERIALS AND METHODS

Directory of Beryllium Copper: 159
A revised edition of their product directory has been issued by The Beryllium Corp. of America. The 20 page directory lists and describes the complete line of beryllium copper, beryllium aluminum and beryllium nickel alloys. Data on pure beryllium metal and beryllium oxide are included.

Temperature Control Catalog: 160
The Burling Instrument Co. has issued a new condensed catalog covering its complete line of differential expansion temperature controls. Included are pictures of current types, a description of their operation, general specifications and an instrument selection chart.

Alloy Steels: 161
A colorful brochure entitled "Alloy Steels" has been issued by the Sheffield Steel Div. of Armco Steel Corp. The brochure describes two low-alloy, high-strength steels. Considerable technical information is included.

Shell Cores: 163
Typical shell cores used in a number of foundries throughout the country are illustrated in bulletin no. 307 that has been published by Shallway Corp. Included are shell cores ranging from 1" to 52" overall length and from 1 ounce to 5½ lbs. weight.

Vacuum Furnaces: 164
High vacuum equipment for melting, heat treating, sintering, annealing, brazing, degassing and purification of metals and alloys is described in an 8 page catalog, no. 552, that has been issued by High Vacuum Equipment Corp.

Titanium Metal: 165
The application of titanium to one of the newest fighter aircraft is described in the October, 1955 issue of the Rem-Cru Titanium Review.

High-Speed Potentiometer: 166
A bulletin describing a new high speed, recording potentiometer has been released by The Bristol Co. The recorder has an 11" wide chart and a full scale pen traverse of only 0.4 second without any overshoot.

Magnesium Topics: 167
A publication of the Dow Chemical Co., "Dow Magnesium Topics" reviews both established uses and suggested new uses of magnesium metal.

Tool Selector Guide: 168
A new pocket guide for the proper selection of Talide metal tools for various jobs has been issued by Metal Carbides Corp. Grade, type, cutting speeds, etc. for all materials is given. Proper rake and relief angles for different materials and types of cut are also given.

Metalworking Lubricants: 169
A newly revised 4 page booklet, listing 42 colloidal and semi-colloidal dispersions for the metalworking, foundry, and related industries has just been issued by Acheson Colloids. Included are dispersions of graphite, molybdenum disulfide, mica, vermiculite, zinc oxide, and acetylene black. Carriers and diluents are given.

Coupling Bulletin: 170
A new descriptive bulletin, no. 240, on the new quick-connect, quick-disconnect coupling is now available from Snap-Tite, Inc. This bulletin describes the coupling, its uses and construction.

High Vacuum Furnace: 171
In the September-October issue of Consolidated Engineering Corp. Recordings is a complete description of the new 1000 lb. vacuum melting furnace recently installed at the Carboloy Dept. of General Electric Co.

Continuous Casting: 172
A five page brochure, issued by American Smelting & Refining Co. describes the continuous casting process used to produce bearing bronze. A comparison of sand, permanent mold and continuous cast structures is given and a table of sizes and weights of available stock bearing bronze.

Standard Conversion Tables: 173
A new bulletin "Standard Conversion Tables," has been issued by the Wheelco Instruments Div. of Barber-Colman Co. Included are thermocouple temperature-millivolt equivalents, Centigrade - Fahrenheit Conversions.

Wax Injection Presses: 174
A new 8 page bulletin provides specifications, photos and prices on Sherwood wax injection presses for investment casting. Two models feature a new quicker acting mold holding device. Alexander Saunders & Co. has issued the bulletin.

Continued on page 72

WHAT IS YOUR TOUGHEST CLEANING JOB IN AIRCRAFT PRODUCTION?

Does any job in the following list give you trouble? If you'll circle the corresponding number in the coupon, we'll be glad to tell how we can help you.

This list of cleaning (and related) jobs was made up with the advice of several of our customers in aircraft production. It shows, in order of volume, the jobs on which Oakite has most frequently been able to save them time and money. Here it is:

1 Cleaning aluminum, steel and magnesium
2 Stripping paint (solvent or hot tank)
3 Machining, grinding, forming
4 Deoxidizing aluminum
5 Steam cleaning aluminum and steel
6 Deflocculating paint in spray booths
7 Preparing metal for painting
8 Removing scale and corrosion
9 Preventing corrosion

FREE Our 48-page illustrated booklet "*How to Clean Metals in Aircraft Production*" contains information on all the cleaning jobs in the list.

SPECIALIZED INDUSTRIAL CLEANING
OAKITE
MATERIALS • METHODS • SERVICE

Technical Service Representatives in Principal Cities of U. S. and Canada

OAKITE PRODUCTS, INC.
340 Rector St., New York 6, N. Y.

Send me a **FREE** copy of your booklet "*How to Clean Metals in Aircraft Production.*"

I especially wish to get better results in the jobs indicated by the numbers circled below:

1 2 3 4 5 6 7 8 9

NAME _____

COMPANY _____

ADDRESS _____

For more information circle No. 79 on the Reader Service Card

USEFUL LITERATURE

Continued from page 71

Vacuum Degasser: 175
The Kinney Mfg. Div. of The New York Air Brake Co. offers Bulletin no. 402 which describes its new mobile vacuum degasser for purifying molten metals.

Flexible Hose: 176
Flexible hose and duct work for dust and fume control, ventilation and for both suction and pressure applications are described in bulletins available from The Flexaust Co.

Aluminum Heat-Treating Furnaces: 177
A new technical bulletin describing furnaces for the heating and heat-treating of aluminum and other light metal alloys from the ingot to the finished product has just been issued by Surface Combustion Corp.

Carbide End Mills: 178
A bulletin describing a completely new line of solid carbide end mills has just been announced by N. A. Ford Mfg. Co., Inc. Eleven different types of solid carbide mills for rough and finish machining are listed.

Heat in Hydraulic Circuits: 179
An 8 page bulletin entitled "Heat, Its Generation and Natural Dissipation in Hydraulic Circuits," has been issued by The Oilgear Co. Included is information on heat transfer area, oil circulation rate, auxiliary pumps, power pumps and pipes and valves.

Fluxes for Aluminum: 180
A series of technical sheets and a listing of products has been issued by Kawecki Chemical Co. Included in the data sheets is information on chemical and physical properties, typical analyses and uses of the several materials available, especially important is a series of fluxes for improving aluminum alloys.

Aluminum Bronzes: 181
A 32 page booklet on aluminum bronzes has been published by W. W. Alloys, Inc. Of value to the designer is basic information on the properties, composition and functions of aluminum bronze alloys as furnished by the company in sand, centrifugal, investment and permanent mold castings, hammer forgings and heat-treated and machined parts.

Meehanite Metal Castings: 182
A brochure called "The Meehanite Reporter" illustrates many uses of Meehanite metal castings. Also available is a reprint of an article on the flame hardening of Meehanite castings.

Wide Mold Bases: 183
Detroit Mold Engineering Co. has issued a pamphlet describing their new 10⅞" wide mold bases. The folder gives all of the pertinent information about this new line of stock bases.

High-Temperature Refractories: 184
A new 32 page catalog from Plibrico Co. covers the entire range of the company's products for the industrial furnace field. In addition to descriptions and illustrations of typical applications a material application chart is included.

Alloy Reference Book: 32
A new, 23 page reference book on die casting alloys has been issued by Henning Bros. & Smith, Inc. In addition to giving the chemistry and physical properties of aluminum, lead and zinc base die casting alloys the booklet contains much useful information on alloy requirements, dimensional stability, alloy dies, etc.

FINISHING

Self Tapping Screws: 187
Self tapping screws in a wide variety of threads, types, and styles are described and illustrated in a 4 page brochure issued by the Parker-Kalon Div., General American Transportation Corp.

Automation: 188
The story of automation in the production of the Plymouth V-8 engine through the use of Ex-Cello built machines is told in the October issue of Ex-Cello Tool Tips.

Crack-Free Chromium: 189
A brochure from United Chromium Div., Metal & Thermit Corp. shows the results of a 100 hour salt spray test on a part with ordinary chromium plate and with crack-free chromium plate.

Colors for Anodized Finishes: 190
A brochure issued by the Sandoz Chemical Works, Inc. describes and shows with actual samples the different colors that can be secured with the dyes developed by the company.

Precision Tools: 191
Two new catalogs have been issued by the Dumore Co. describing their automatic drill units, automatic drill heads, small diameter drill grinders, and other precision tools for production, tool room and maintenance.

Abrasive Belt Grinding: 192
A new 31 page booklet on increasing production through the use of abrasive belts has been announced by the Engelberg Huller Co. Application studies are grouped according to each of five types of abrasive belt machining.

Electrocleaning of Die Castings: 193
A folder issued by Oakite Products, Inc. describes and gives step-by-step instructions for the electrocleaning of zinc base die castings prior to plating.

Tumbling Machines: 194
A new catalog has been issued by Rampe Mfg. Co. showing their line of tumbling machines, screen separators, Nylaslugs, etc. A price sheet is included.

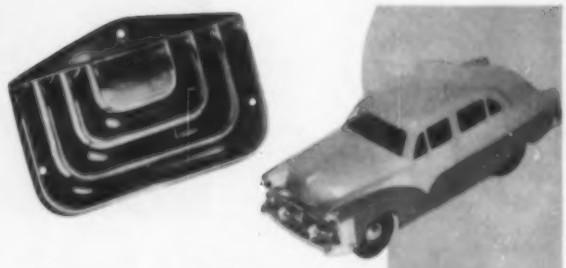
Heat Exchangers: 195
Heat exchangers for all plating, pickling and anodizing solutions are fully described and illustrated in a new catalog available from Carl Buck & Associates. Included are proper materials of construction for different solutions used and formulae for determining the size of unit needed.

Carbide Tooling: 196
Designed for use with replaceable carbide cutting tips, the new Dex A Tool tool holder manufactured by Adamas Carbide Corp. is described and illustrated in a new catalog now available.

Laboratory Reports: 197
Laboratory verified reports on the best methods for finishing both aluminum and zinc base die castings are available from Frederic B. Stevens, Inc. Ask for Stevens Technical Bulletin PP-125.

Tapping Heads: 198
Featuring a positive torque control which instantly stops the tap when it becomes dull, loaded or bottoms is one of the features of the new Tapmatic head described in a brochure from Tapmatic Corp.

Midget Mills: 199
A new line of 3/16" shank midget mills in the so-called Carbo-Mill line has been announced by Severance Tool Industries, Inc. A brochure, describing these new mills and some additions to the older lines is available.



FIORE MASKS FOR PRECISION PAINTING

Spray decorating methods have improved so rapidly in recent years that you may not be aware of some time-saving, money-saving techniques now available. Today, special Fiore designed spray masks and fixture devices make possible single or multi-color decoration with precise registration on irregularly contoured products.

IF { your product is judged on appearance / you want best possible results / you want a minimum of rejections

CONSULT US

Send for your FREE copy of our 20-page book which shows the different types of masks and gives case-study illustrations of their use. Or send your samples and drawings for consultation and estimates.

WM. M. FIORE INC.

269 41st Street Brooklyn 32, New York

For more information circle No. 27 on the Reader Service Card

PRODUCT NEWS AND DEVELOPMENTS

to get any of the free materials described here, circle the appropriate number on the reader service cards bound into this issue

BATCH WASHING SMALL PARTS WITH HIGH PRESSURE SPRAY

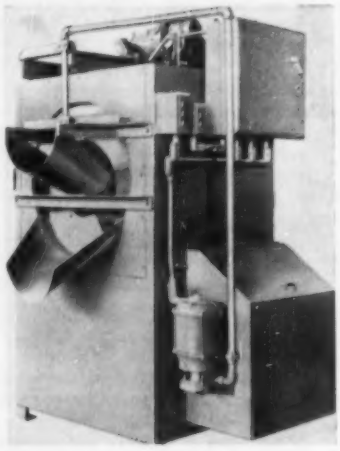
Small parts can be high-pressure spray-washed economically in bulk by means of a small rotary-drum batch-type machine recently introduced.

Parts batches are introduced into the machine through the upper chute. The one-man machine utilizes a drum with helical baffle to tumble parts gently and expose all surfaces thoroughly to the high-pressure fan-shaped spray nozzles inside the drum.

The drum, perforated to permit draining of the solution, oil, chips and impurities, retains only the clean, thoroughly washed parts. On completion of the cleaning cycle, the drum counter revolves, automatically discharging the clean parts into a tote box or other container through the lower chute.

Design of the machine is such that required floor space is held to a minimum and permits installation directly against other machinery, walls or supporting structures. The entire cycle can be made either fully automatic or manual. On the automatic installations an adjustable timer is provided.

The Alvey-Ferguson Co.
For more information, circle No. 205 on the Reader Service Card



COMPLETE PLATING PLANT IN PORTABLE UNIT

Incorporating the features and automatic equipment usually found in large, mass production plating installations, a new unit is said to be a complete electroplating plant in a compact, portable unit.

The plater consists of a selenium rectifier with automatic timer, stainless steel tank (which may serve as the anode) fitted with a water jacket for temperature control; a movable work rack which will accommodate a portable plating barrel; a centralized control panel equipped with an ammeter and power control; a filter; and a drip-proof pump with motor.

The unit has a unique jet method of agitation. This is accomplished through a pump and perforated stainless steel tube at the bottom of the plating tank. The resultant constant motion of the solution around the work, the manufacturer states, assures consistently smooth, even deposits, and high quality plating.

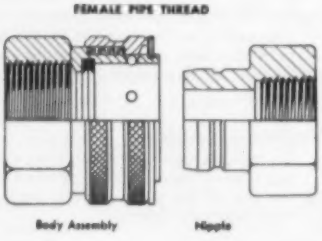
Bart-Messing Corp.
For more information, circle No. 207 on the Reader Service Card

LEAK-PROOF COUPLINGS IN HEAVY DUTY MODELS

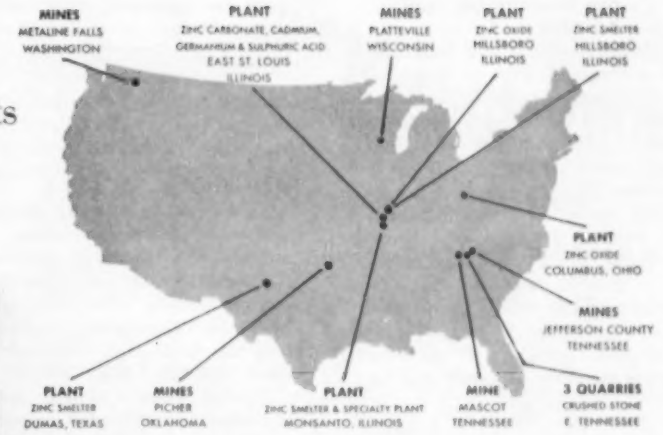
A quick-seal leak-proof coupling is now available in heavy-duty models for high pressure, heavy flow applications in the steel, oil, chemical and construction industries.

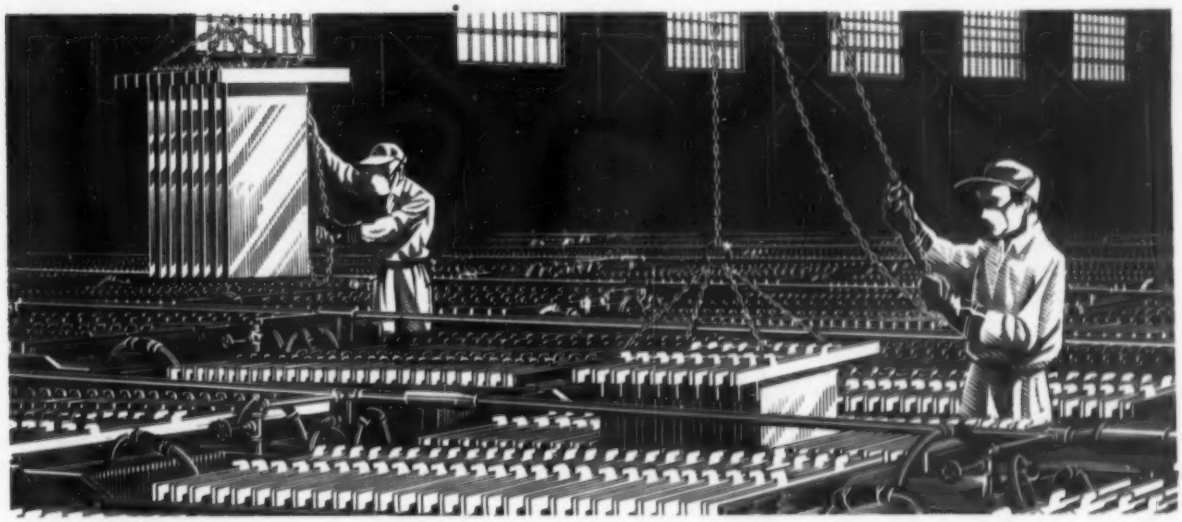
The coupling is based on a simple construction which makes the hose line leak-proof the moment the nipple is seated in the coupling body, and seals it tighter, the higher the pressure builds up. In addition, the coupling has a full swiveling feature that prevents hose kinking, thereby insuring long hose life and permitting rapid hose attachment. These features are said to make the coupling particularly successful in heavy industrial applications, where the hose line carries a very large flow, where the line pressure is high or both.

Titeflex, Inc.
For more information, circle No. 213 on the Reader Service Card



American Zinc and its products *from* A *to* Z





OPERATIONS AT MONSANTO, ILLINOIS

Modern and recently expanded electrolytic plant producing special high grade slab zinc, which is sold primarily to the die casting and brass manufacturing industries. In conjunction is a specialty plant for the production of zinc ball anodes, heavy plating anodes and anodes for cathodic protection. For complete picture of American Zinc operations, see map above.

PRODUCERS OF

ALL GRADES OF SLAB ZINC
ZINC ANODES (Plating & Galvanic)
METALLIC CADMIUM
SULPHURIC ACID
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THROWAWAY TOOL INSERTS . . . for mechanical tool holders

Announcement has been made of a complete line of throwaway tool inserts for use in mechanical tool holders. These blanks are available in both precision ground and utility styles, ground top and bottom. The inserts come in a new "600" series Steel Cutting Grades as well as those grades recommended for machining cast iron and non-ferrous metals. The blanks are available in 12 different sizes—rounds, squares and triangles.

Carmet Div. Allegheny Ludlum Steel Corp.
For more information, circle No. 211 on the Reader Service Card

FINISHING MATERIAL . . . minimizes "spotting out"

A new product, Luster-On NS, has been announced that is said to be the answer to "spotting out" troubles on thin copper and brass plate, especially under humid conditions. It is also suggested where porous castings are difficult to rinse. It prevents tarnishing and eliminates finger printing in assembly operations. Improved adhesion, leveling action and lacquer savings are other advantages cited.

The Chemical Corp.
For more information, circle No. 212 on the Reader Service Card

ALUMINUM SOLDER . . . bonds to copper, brass

A new solder has been announced for bonding aluminum to copper, brass and other nonferrous metals. The solder contains no aluminum, cadmium, lead or antimony and may be used like any other solder.

No flux, special skill or special equipment are needed according to the manufacturer. The solder is highly resistant to corrosion and retains its original bright color after application.

Because of its copper content, the electrical conductivity is said to be higher than other solders available. It melts at 700-750F, high enough to prevent failure where aluminum is used hot such as some radar and television applications.

Ultralloy Corp.
For more information, circle No. 208 on the Reader Service Card

DRY LUBRICANT . . . reduces oxidation, corrosion

A new, permanent and dry lubrication process is reported to be available for application to all metallic surfaces. This method is said to be most beneficial where ordinary oils and greases are not feasible or desirable; and is especially valuable in cases where parts must function without failure.

The new lubricant impregnates and film coats any metallic surface and leaves no surface build-up. Impregnation into the metal pores assures the presence of lubricant even after prolonged wear.

Oxidation, corrosion and friction are greatly reduced and "sticking" is prevented. The lubricant is effective in the temperature range of minus 30F to plus 800F.

U. S. Engineering Co.
For more information, circle No. 209 on the Reader Service Card

POLISHING MACHINE . . . handles work up to 24"

A new, wide face polishing wheel designed to handle work up

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Inside Story

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A complete feature analysis on the amazing Procunier Tapping Line is yours for the asking! Gives a true "peephole" story on the many outstanding construction improvements, the mechanical advancements and precision quality operating advantages that make Procunier heads a "must" in production plants everywhere! You'll learn why Procunier means more tapping hours with minimum "down-time", faster production with fewer broken taps, fewer spoiled pieces and a "new-found" operating ease that helps operators maintain stepped-up production schedules. Find out how you, too, can benefit with Procunier in your plant.

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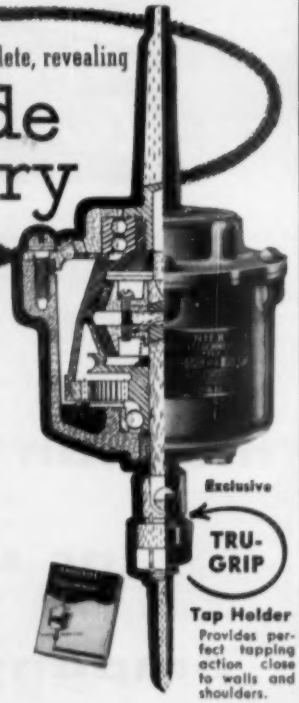

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For more information circle No. 81 on the Reader Service Card

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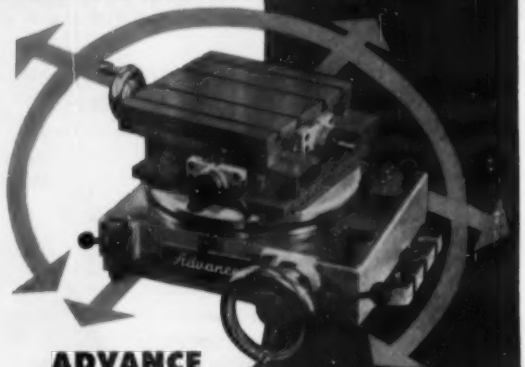
by reducing set-up time as much as 90% With Jig Boring Accuracy



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ELECTROFLO VALVE

An electrically operated valve for controlling on and off flow of fluids. For large flow volume.

SHUR-FLO INTERLOCK

A control to protect equipment when flow is below a desired minimum; or above a desired maximum.

MESURFLO CONTROL

A flow volume control to deliver an set rate of fluid flow, regardless of variable inlet pressures.

ELECTRO-MITE VALVE

A direct action solenoid valve for small flow volume. Available with volume control.

STRAITFLO STRAINER

A straight line strainer, installed in the supply, having the entire strainer area within the flow-way itself.

ELECTRO-MESURFLO VALVE

An electrically operated valve with flow volume control. For medium flow volume.

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If your problem concerns a specified flow of fluid or time-fill, we suggest you design Hays *automatic* flow controls into your equipment. Hays products are trouble-free and offer absolute internal water control. They are low cost, and eliminate the need for such components as pressure regulators, filters, and other devices.

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Circle No. 30 on the Reader Service Card

to 24" wide has been announced.

The polisher is reported to have a floating action so that a single wide face polishing head will buff and polish an entire 24" surface, thus cutting down the number of heads required for large work. Positioning of the work is said to be simplified and once the proper pressure is established, hundreds of pieces can be processed uniformally.

Murray-Wray Corp.
For more information, circle No. 210 on the Reader Service Card

ETHYL SILICATE . . . of extra high purity

One of the producers of ethyl silicate for the investment casting industry has announced a new process that enables them to produce extremely pure ethyl silicate, both 28% and 40%.

The extremely high purity of the material makes it stable in the presence of moisture and even when in contact with water. One advantage that immediately results is the elimination of sediment in storage tanks—a trouble frequently encountered in less pure material. No additives, which might interfere with subsequent use, are employed to give the added stability.

R. W. Greeff & Co.
For more information, circle No. 220 on the Reader Service Card

VAPOR DEGREASERS . . . complete existing line

Because of the limitation on the size of parts that could be handled in their present line of barrel degreasers, one manufacturer has added two new rectangular shaped units.

The new units are fabricated from 12 gauge and 3/16" steel plate for longer life and are protected against corrosion with a phenolic interior coating. The new models are said to retain all the low cost advantages of the barrel degreasers while providing such heavy duty features as a full water jacket, offset coil condenser and complete manual spray equipment.

Cleaning is accomplished with nonflammable trichlorethylene vapor. The parts are lowered into the vapor zone of the machine and automatically cleaned, generally in a few seconds. Only twelve gallons of solvent is required for operation and the reclaiming feature of the unit permits considerable savings in solvent.

Baron Industries
For more information, circle No. 222 on the Reader Service Card

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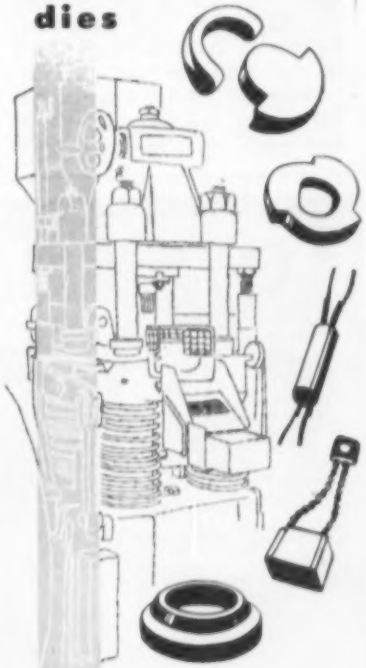
in building high production compacting dies



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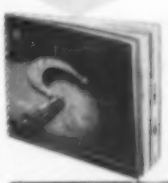

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Circle No. 19 on the Reader Service Card

BARREL FINISHING COMPOUNDS
. . . for zinc die castings

Two new barrel finishing compounds which the makers state will produce outstanding results on zinc die castings have been announced. These compounds can be used for the cut down and burnishing cycles.

The first of these, called ESBEC No. 655, is a mild abrasive compound to produce ultra smooth surfaces in short cycles, rinsing completely at the end of the cut-down run. The second, ESBEC No. 205, is then used for a short burnishing cycle for high lustre on zinc alloy die castings.

The manufacturer suggests that burnishing can sometimes be eliminated by lengthening the honing cycle, although highest quality lustre calls for use of hardened steel balls with the No. 205 compound.

Esbec Barrel Finishing Corp.
For more information circle No. 221 on the Reader Service Card

AIR COOLED BUFF
. . . improves wiping action

An air cooled bias buff that is reported to be completely different in type, has been introduced. The new buff features 45 degree angle biasing which is said to result in a 23 percent increase in the number of warp fibers per inch of fabric on the working surface of the buff. This also gives one-way warp direction for maximum cutting and polishing efficiency.

Uniform convolution pleats produce a wiping action and practically eliminate streaking, give better fabric distribution and more perfect balance. Down time for balancing of polishing heads is said to be eliminated. Air scoops are provided in the center of the buff to produce forced air ventilation and cooling action during operation. The buffs are stitched with piano wire for greater safety when operating a maximum speed.

James H. Rhodes & Co.
For more information, circle No. 223 on the Reader Service Card

ULTRASONIC GENERATOR
. . . Operates at 20,000 cycles

The ultrasonic barrier to full scale manufacturing operations including soldering, drilling, grinding, plating, cleaning and degreasing has been broken by the introduction of low cost high frequency rotating generators ranging in size from 2 to 150 KW.

These alternators are capable of supplying economical power for energizing multiple arrays of above-audible sound generating transducers needed to irradiate materials and products being processed en masse, as in degassing molten metals, plating, cleaning and degreasing, cutting, drilling, grinding, etc.

The generators are said to be able to transfer laboratory ultrasonic experimentation into full-scale production. The generators replace much more expensive electronic supply units which have been necessary before and have limited the application of ultrasonic techniques.

Acoustica Associates, Inc.
For more information, circle No. 224 on the Reader Service Card

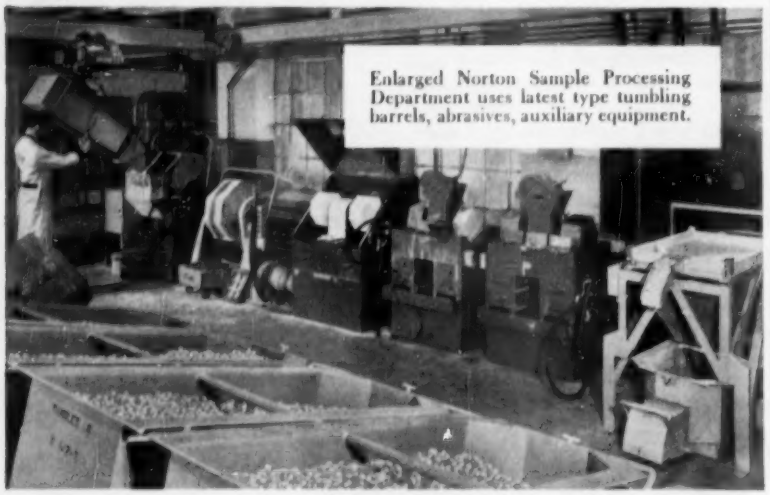
HOLD DOWN CLAMP
. . . for use in close quarters

A new model Tee Clamp for use on drill presses has been introduced. This clamp, which largely follows the design of an older model has been improved by forming a taper on one end of the hold down bar which enables it to be used in close quarters.

Another improvement is the incorporation of a V notch which makes it easier and safer to clamp round and odd shaped material.

The maker says that the new clamp can be set up in about half the time required for a standard C clamp.

Hunter Tools
For more information, circle No. 225 on the Reader Service Card



Enlarged Norton Sample Processing Department uses latest type tumbling barrels, abrasives, auxiliary equipment.

See what barrel-finishing can do

If you're still finishing metal parts the long hard way — take a look at what Norton is demonstrating with modern equipment, materials and processes in its newly enlarged Sample Processing Department.

Deburring . . . descaling . . . better color . . . better finish . . . lighter cuts on die castings without cutting under the smooth outside surface — what's your problem?

If you will send us sample parts (and they can range from tiny needles to hefty forgings) Norton production engineers will give you a detailed report on what tumbling will do for you.

What To Send Us

Along with your unfinished parts please forward: (a) a finished sample to be matched (hand-finished if necessary); plus (b) information on your present barrel finishing equipment, if any, including type and size of barrel and speeds. Address the Sales Engineering Dept., Abrasive Division. NORTON COMPANY, Worcester 6, Mass.

G-301

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SHOT GUNS
continued from page 40

In this part an investment casting not only showed all of the advantages noted above for the breech lock but, in addition, allowed the use of a design that would otherwise be too expensive or practically impossible to achieve. The sharp "V" shaped recess could not be milled economically and to secure the desired shape would have required the assembly, probably by silver soldering, of at least two components.

The four integrally cast rivets provide a far stronger assembly than could be secured by any other method and here the investment casting process allowed incorporation of a good design feature not otherwise possible.

The slide is cast in 6150 steel and like the lock is heat-treated to a hardness of 45 Rockwell "C". In this part, as in all of the others, it was found that during pouring and cooling, a decarburized surface layer from 0.005 to 0.010 deep was developed. Since this decarburized surface layer would not harden the same as the core it became necessary to re-carburize. This latter step is combined, of course, with the hardening by heating in the carburizing salt bath to about 1550 to 1600 F for 15 minutes, oil quench and then reheat to about 800 F for about ½ hour and air cool. Such a heat treatment will give the desired hardness and will build up the carbon content of the case to give the required wear surface.

As in the case of the breech lock, the original single cavity design was modified prior to making a multiple cavity mold. The differences in design are readily apparent in Figure 2.

Final machining of this part is to drill one small hole and to polish one surface, both inexpensive operations.

Double Cavity Mold Cuts Costs

The hammer and sear, Figure 4, are also cast in 6150 steel and heat-treated to the same hardness as the other parts. In the case of these parts, some direct cost comparisons are available. Based on the cost of the finished part when a single cavity mold was employed, the cost of the hammer machined from bar stock was 20 percent less.

However, when a multiple cavity mold was used, the cost of the investment casting dropped to 58 percent of the single mold cost. An even greater saving was shown in the case of the sear. Again based on the per piece cost when a single cavity mold was used, the cost when a multiple cavity was employed was reduced by 55 percent. The savings noted for these two parts are characteristic of all of the investment castings used.

Practically no machining is done on any of these castings. In almost every case the design allows tolerances of ±0.003 and the foundry is able to hold to these requirements. Where this accuracy is not good enough or where the as cast surface is not adequate, simple surface grinding is sufficient.

QUALITY CONTROL
continued from page 47

The next three items in Table 1—radiographic soundness, visual inspection standards, and fluorescent penetrant inspection—all help determine the soundness of the investment casting. In the initial negotiations with the investment-casting foundry, the buyer should specify whether X-ray and fluorescent penetrant are required and the degree to which they are to be employed, i.e., 100 percent or something less. The details of the X-ray and fluorescent penetrant standards are generally not discussed during the

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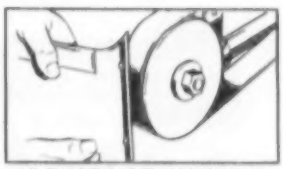
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purchase negotiations, although they should be available to the foundry before any parts are produced. Since the investment-casting foundry is accustomed to producing castings that are completely X-ray sound and capable of passing rigid fluorescent penetrant inspections, many jobs are negotiated without going into the details of these specifications.

Visual inspection standards also are not usually discussed in detail during the initial purchase negotiations. However, these standards should be in the hands of the investment-casting foundry before any parts are cast.

The visual inspection standard must establish the degree to which surface defects will be allowed. It must also describe what constitutes a surface defect. Further, it may list the allowable surface finish requirements for various areas of the part.

A gas turbine blade may be used to indicate how the visual inspection standard can accurately break down a part on the basis of the critical nature of the various areas. The areas along the leading and trailing edges and the fillet intersection of the airfoil to the buttress platform are sections under high vibrational loads where any imperfections could originate a fatigue failure. Therefore, no imperfections are allowed, i.e., nicks, pits, cold shuts, or grind marks. The surfaces along the airfoil between the leading and trailing edge, and the underside of the shroud and the fillet between the airfoil and shroud are areas of lower stresses and lower vibratory stress concentrations. In these areas minor imperfections are allowed, i.e., nicks and pits, the allowable diameter, depth, and spacing of which should be clearly specified. On all the surfaces of the casting to be machined, imperfections are allowed that do not extend below the depth of the stock to be removed. The allowable depth of the imperfections should likewise be specified.

Normally standards are more complex than the example given; some parts may have as many as five areas with different visual requirements, depending on the design stresses, etc. Again, clearly defined visual standards should be supplied to the foundry so that proper surface-defect standards can be established.

The final control requirement in Table 1 is that of identification of the part. Although identification may appear to be of minor importance, it is actually an essential requirement of every investment casting. Some of the items which should be included in the part identification are the part number, the pattern or mold number, the material employed, and the heat number of the particular alloy. In addition, the date the casting was shipped and the foundry name should be included. This identification assures the customer that a part has been made from an approved mold and from metal of approved physical properties. Proper identification symbols should also be marked on the casting to indicate that X-ray and fluorescent penetrant inspection have been performed. It is common practice to electro-etch the necessary identification on the casting. Mold and part number identification may also be produced in raised letters on the casting by stamping or cutting this information in the pattern-producing equipment. The method of etching should not disturb the metallurgical structure or finish of the casting surface.

Part 2 will appear in Feb. PMM.

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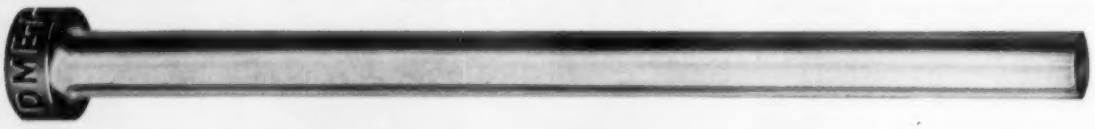

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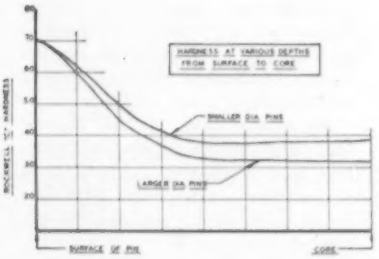

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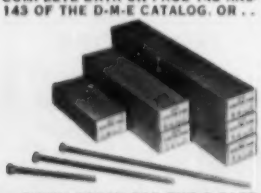

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3355

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This Design Will Never Back-Fire

WHERE large numbers of gas fired devices are used throughout a plant, it is common practice to install one master unit which mixes air and gas and forces this mixture, under low pressure, through pipe lines to the various points of use.

With such a system, some sort of device must be installed in the line to prevent back-fires. The unit to give this protection that is made by the C. M. Kemp Mfg. Co. utilizes a plurality of metallic gauze units to dissipate the heat from a backfire in the same manner that the traditional miners safety lamp uses metallic gauze to prevent gas explosions.

To give adequate protection on a 12 inch diameter pipe line, for example, 288 separate gauze disc assemblies are used; each one of which must have a separate mounting device.

One of these back-fire preventers is shown. The assembly consists of a die cast zinc retainer, a plurality of metallic gauze discs and a steel backing ring to hold the discs in the casting.

When this device was first designed the retainer was designed as an iron sand casting. The part required a very considerable amount of machining before assembly could start and cracked castings were common.

To lower incidence of cracked castings and also to lower manufacturing costs, a change was made. The Electric Auto-Lite Co. makes these die castings and has eliminated all machine work other than to chase the cast thread.

The change from cast iron to a zinc die casting has materially lowered the production cost of these units, made production far easier and simpler and has completely eliminated cracked castings.

"TREE SURGERY"

can now be done by the Do-It-Yourself "boys" with a lightweight DIE CAST ALUMINUM 3-WAY TREE TRIMMER

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WAXES

continued from page 54

resulting in uniform, close-tolerance patterns.

Microcrystalline Waxes

Two distinct types of wax are derived from crude petroleum. These are the paraffin waxes and the microcrystalline waxes. Of these, the investment casting industry is mainly interested in the microcrystalline type. These waxes derive their name from the fact that upon solidification crystal formation is in the microscopic range. This phenomenon imparts to the solid wax a plastic, ductile characteristic which is of extreme value in patterns for the investment casting industry. Due to the crystal structure of the wax, internal stresses formed during casting are more easily relieved than with most other materials. The ability of patterns to recover without cracking after deformation can also be traced to the crystal structure of the wax.

The family of microcrystalline waxes includes a broad range of materials which extend from waxes that are soft and tacky and have melting points in the 140 F. range up through the very hard waxes that melt around 200 F.

For investment casting applications those waxes lying in the middle of the range are most suitable. The waxes in this range have characteristics which are common to all microcrystalline waxes generally, in that they are plastic and ductile. Their melting points are in the 170 to 185 F. range and they are sufficiently hard that surface tack is not a problem and yet not hard enough to have reached the brittle stage.

Microcrystalline waxes are used in pattern waxes to reduce brittleness and contribute strength, toughness and smoothness to the compounds and the resultant patterns. They also tend to give good flow properties over extended temperature ranges. Because of these very useful characteristics and the fact that their ash content is practically nil, microcrystalline waxes are used in high percentages in pattern wax compounds. Their relatively low cost also offers a considerable economic advantage to the investment casting industry.

Pattern Wax Compounds

In adapting microcrystalline waxes to a wide range of uses in pattern making, gums, synthetic resins, vegetable waxes and other compatible materials have been blended with them, each adding certain required properties of the desired pattern wax. The pattern wax blender has relied chiefly upon the producer of microcrystalline petroleum wax for his raw material. Many of the most desirable blends contain over 50 per cent microcrystalline wax. Some such blends are offered by wax jobbers or blenders, who also prepare blends to an investment caster's own formula or specifications. Some large casting firms prepare their own blends as required.

A microcrystalline wax that has the necessary hardness will of necessity have a melting point too high for most practical injection purposes. Although microcrystalline waxes are produced which have melt points as high as 200 F. and penetration hardness in the range of 2 and 3, the practice of pattern wax formulation generally centers around those with a melting point of 170 to 185 F. and a penetration value of 8 to 12.

The need for a finished wax with a penetration of 6 to 8 demands the addition of a hardening agent. Such additives are candelilla, palm wax, carnauba and other hard vegetable waxes. These materials make the blend harder — give lower penetration values — without materially increasing the melting point. In some instances the melting point is actually lowered, which is very desirable for use with most wax injection equipment.

At this step in the blending, a wax is provided of sufficiently low melting point and enough hardness, but it may fall short in ductility and elasticity. To correct this, gums and resins, either natural or synthetic, are used as plasticizers. After the selection of the proper plasticizer, the formula is precisely adjusted percentagewise in order that the best combination be obtained. A highly fluid pattern material is preferred for reproducing thin sections of intricate or sharp outline and a less fluid wax is satisfactory for patterns of thicker section with less intricate contours.

Continued next page

Most casting firms employ two or more separate blends of investment pattern wax to meet requirements based on patterns of different sizes and shapes. It is believed by some that four blends covering the practicable limits of specifications might satisfy the casting industry in this regard, although eight and more blends are in use by some firms. Dyes of various colors are introduced into the waxes of different specifications for ease of identification; also to minimize eye strain in visual inspection and facilitate inspection of wax welds between sprues, runners, pattern assemblies and clusters.

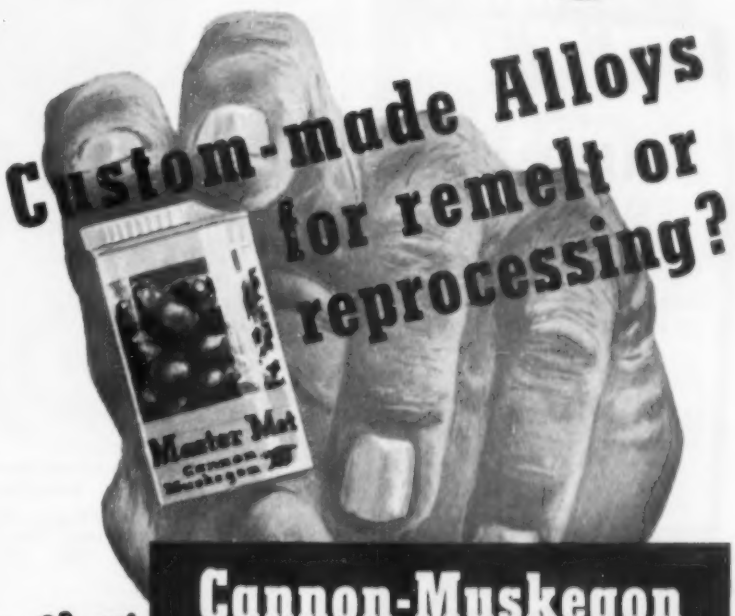
Up to the present time most exact pattern wax formulas prepared for a specific use by a pattern caster or blender fall in the realm of individual choice and trade secret. Moreover, it would be difficult for a blender to prepare a usable pattern wax based merely on a set of physical specifications furnished by the casting operator. This is due to the fact that pattern waxes which test identically by present test methods may yet perform differently.

Actually, more work must be done to develop test methods which will adequately indicate the performance of a given wax or wax blend as a pattern material. There are some facts, however, by which industry may be guided. The melting point should not be below 150 to 160 F; any lower pattern wax melting point may give rise to undue softening and distortion during hot weather. The upper limit of the melting point is dependent upon the operator's equipment and facilities for injection; a penetration value of from 5 to 8 will give sufficient hardness for rigid pattern. The hardness, or penetration value, may well be above or below the 5 to 8 limits if this does not materially and unfavorably alter other properties of the finished pattern wax.

Testing Uniformity Of Waxes

Most tests now used for evaluating pattern waxes were devised for laboratory measurement of wax properties which are of interest in other industrial fields. Some of these tests which are of interest in other industrial fields. Some of these tests which are available in the investment casting field for classification of wax pattern materials are penetration (hardness), viscosity, en-

Need pounds or tons of



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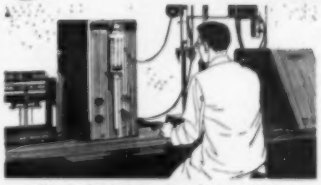
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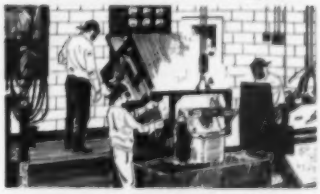
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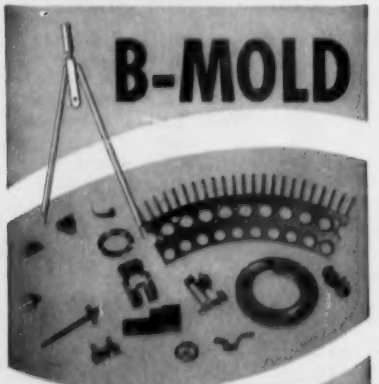

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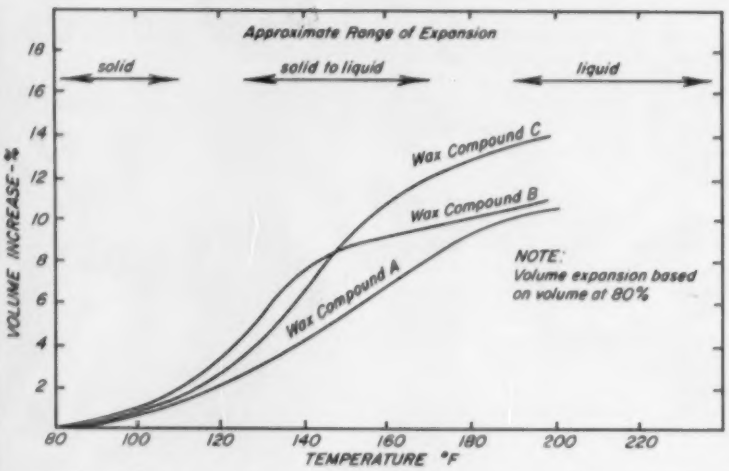
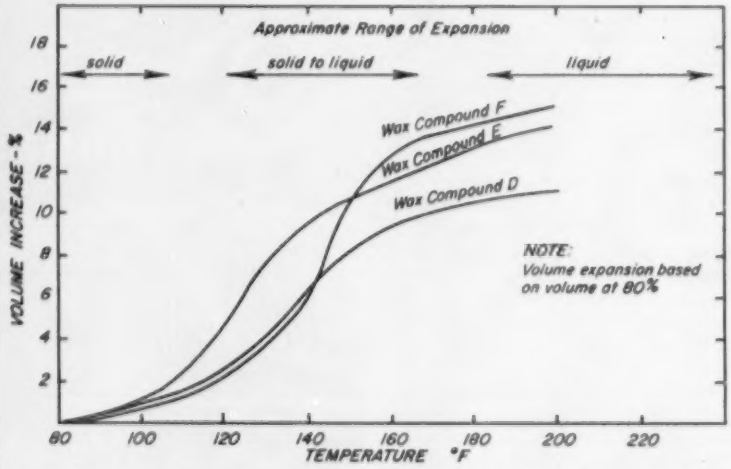


EXPANSION of compounded investment casting waxes. (See Tables 1 and 2 on page 53.)



EXPANSION of compounded investment casting waxes. (See Tables 1 and 2 on page 53.)

thalpy, dilation (expansion), softening point, congealing point and melt point. These are combined with practical shop tests such as actual injection runs, after which the resulting "feel" and "appearance" are noted.

Assuming that we have selected a pattern wax which meets the requirements according to the tests for the physical properties listed previously, it can still be said that no one physical testing method has yet been established which will classify its performance as an actual pattern. There is considerable evidence that stress-strain curves may give valuable information on the operational conduct to be expected from a given wax formulation. One testing method has been devised whereby a wax bar of rectangular cross section is placed under various stress loads for given periods of time, and alternately loaded and unloaded. The strain is measured after each unloading and a fairly comprehensive picture can be obtained, making possible an estimate of the conduct of the wax pattern without expensive production evaluation.

Many production factors such as dimensional tolerance limitations, intricacy of pattern, speed of injection, etc., require that the pattern wax be formulated within narrow limits. In order to duplicate his material batch after batch, the blender or casting shop must be able to obtain raw materials with a high level of uniformity or be able to test them comparatively against his standards, so as to make any necessary adjustments in his formulation.

The art and science of refining

and manufacturing microcrystalline wax by leading sources has reached a high level, so that users may now feel confidence in the uniform quality and properties of their wax production. This trend is also true for most of the compatible synthetics. The lack of uniformity of most natural waxes, however, still presents problems for the user who undertakes to duplicate or maintain any formula containing them.

Considering that some casting operators now use waxes in carload quantities monthly, it becomes a matter of considerable economy that the basic component of a pattern wax carry a low per pound cost. Microcrystalline wax emphatically fits into this overall picture, as its cost is quite low in comparison with other types of waxes and injection materials. Since a wide variety of microcrystalline waxes is being produced, the problems of variety, economy and dependability of supply are reasonably reduced for the wax user.

While several properties are accepted as being of prime importance to pattern waxes, it is recognized that the field is fertile for further research. It is fairly common knowledge that the specifications on which waxes are sold do not necessarily foretell their usefulness to an investment caster. Two waxes may possess practically identical melting points, penetration, and viscosity, and yet perform in a very different manner when molded.

As impetus is gained by the investment casting industry, an increasing amount of attention is being given to its problems by the suppliers of raw materials. The wax producer is no exception and is devoting much attention in his research and development laboratories to the manufacture of these special grades of wax, and to the problems involved in the production and blending of a range of universally acceptable pattern waxes. The original and supporting quality control which some wax manufacturers apply to their products further simplifies the problems of the wax user.

How Wax Compounds Compare

Several precision investment casting wax compounds used on a commercial scale were recently submitted to the testing procedures commonly used for petroleum and natural waxes. From the results shown in Table 1, it is

Continued on page 89

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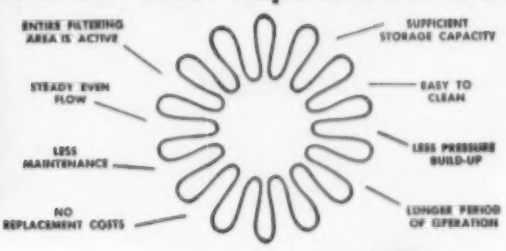

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Both sump and line types may be easily disassembled, cleaned and reassembled by any workman, on the spot, in a matter of minutes. Line type operates in any position and may be serviced without disturbing pipe connections.

A SIZE FOR EVERY NEED

Available for sump or line installation in capacities from 5 to 100 G.P.M. Greater capacities may be attained by multiple installation as described in catalog. Choice of monel mesh sizes range from coarse 30 to fine 200.

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Both sump and line type filters have been adapted for use in all water filtering applications. No changes have been made in the basic, balanced synclinal design.

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Marvel's most recent development is a filter for the efficient filtration of all types of fire-resistant hydraulic fluids.

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NEWS OF INDUSTRY AND ASSOCIATIONS

ACCURATE DIE CASTING COMPLETES EXPANSION

The Accurate Die Casting Company, 3089 East 80th Street, Cleveland, Ohio, a leading producer of aluminum, zinc and magnesium die castings has added 23,500 square feet of newly constructed space.

Included in the expansion are two new plants, each mechanized with the most modern equipment. The first plant has a work area of 4000 square feet and is devoted to magnesium die castings. The second, with 11,000 square feet, is for the production of aluminum die castings. In addition, the existing tool and die room facilities were increased by 8500 square feet.

The new facilities, designed to help meet the growing demand for die castings, have increased Accurate's production capacity by more than 40 percent, according to M. N. Suvak, Accurate president.

LOREN C. HURD HEADS METALS DISINTEGRATING

Announcement has just been made of the appointment of Loren C. Hurd as the new president of Metals Disintegrating Co. He succeeds H. E. Hall who died last summer.

Loren C. Hurd

Prior to coming with M. D., Dr. Hurd was technical director of the export department for Rohm & Haas Co. He holds degrees from both Carleton College and the University of Wisconsin and has studied at the Hanover Technische Hochschule, in Germany.

At the same time, the company announced the appointment of D. C. Bradley as General Manager of its Pulverizing Machinery Division.

BECK RESIGNS AT APEX

Wm. A. Singer, chairman of the Apex Smelting Company, has announced that effective December 1st Robert K. Beck has resigned as president and director of the company. Mr. Beck also resigned as officer and director of the company's subsidiaries and affiliates.

Robert K. Beck

Louis Lippa, who has been in management and a director of the company since its inception, has been elected to the office of president.

MANAGEMENT CHANGE MADE AT AMERICAN ZINC INSTITUTE

F. S. Mulock, president of the American Zinc Institute Inc., has announced that Ernest V. Gent, who has served the Institute for 20 years first as secretary then as executive vice president, has retired from office as of December 31. John L. Kimberley, now secretary of the Institute, has been appointed executive vice-president in his stead and took office January 1, 1956, Mr. Mulock said.

E. V. Gent J. L. Kimberly

Mr. Gent has been active in zinc industry affairs since 1925 when he was manager of the Zinc Export Association. He became seretary of the American Zinc Institute in 1935, and in 1941 was called to Washington to serve as special consultant to government agencies concerned with defense and war efforts. He has served as executive vice-president since 1948. Commencing with the new year, Mr. Gent will continue to serve the Institute as a special consultant.

Mr. Kimberley was elected secretary of the Institute in April of this year. He was formerly sales manager, Continuous-Cast Alloy Products Division of the American Smelting and Refining Co., and before that was a metallurgist with the Scovill Manufacturing Co. Between 1942 and 1944 he served with the War Production Board and the U. S. Navy. He is a graduate of Yale with a B.S. in Mechanical Engineering and an M.S. in Metallurgy.

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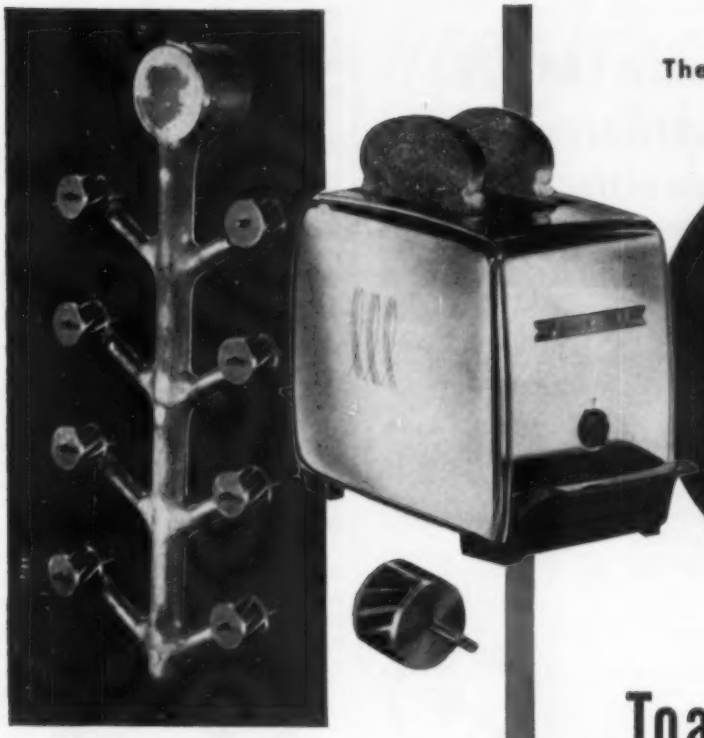

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to make the heart of the motor...
a tiny aluminum rotor

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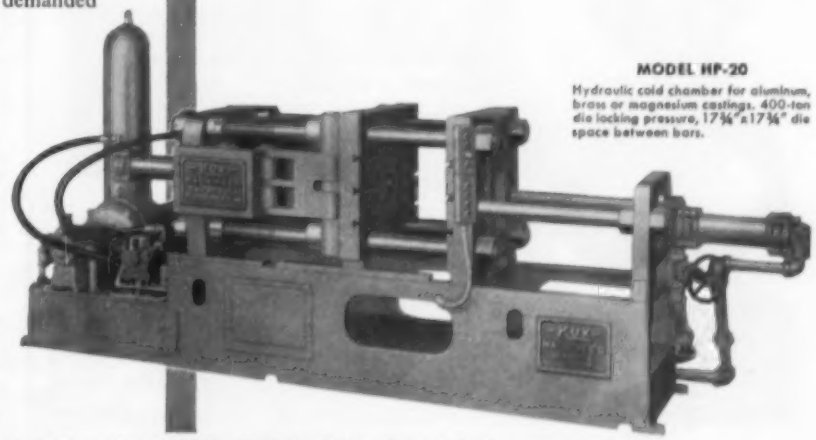
It's an amazing automaton, thanks to the tiny aluminum die cast rotor that is the heart of the small powerful motor that serves as the elevator for the bread. A KUX Model HP-20 die casting machine was chosen to produce the rotors because of its long record of dependable service in turning out castings of fine detail and quality. As Toastmaster says, "the rotors meet the high standards demanded of every Toastmaster toaster part."

KUX produces a full range of modern die casting machines that require only the touch of a push button to put them automatically through a complete casting cycle that consistently turns out quality castings at high production speeds. Write for our detailed illustrated catalog.



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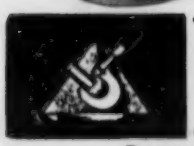

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OPENS DALLAS WAREHOUSE

A new warehouse designed to serve the South and Southwest area has been opened in Dallas, Texas, by Aeroquip Corporation, Jackson, Mich.

Located at 102 Express Street in Dallas, the warehouse will provide faster and better service for Aeroquip customers, supplementing the shipping facilities of the company's Van Wert, Ohio, subsidiary, Aeroquip, Inc.

Clyde Stratton, formerly in the production control department at the Jackson plant, and the purchasing department at the Ohio subsidiary, is the warehouse manager at the Dallas location.

LEBANON STEEL FOUNDRY APPOINTS RESEARCH DIRECTOR

Lebanon Steel Foundry has appointed David C. Ekey as director of research, it was announced recently by W. H. Worrilaw, president.

Dr. Ekey

Dr. Ekey will direct an expanded program of research into new casting techniques and procedures, Worrilow stated, and will head a staff of approximately 25 engineers, who are already working at the Lebanon foundry.

Dr. Ekey was recently assistant professor of industrial engineering at Pennsylvania State University where he has been head of the Foundry Option Course since 1951. During the last few years he has also served in the capacity of project engineer at Chambersburg Engineering Company, Chambersburg, Pa., the Office of Technical Services, Washington, and The J. I. Thompson Co., Bellefonte, Pa., where he assisted in establishing inspection standards for the U. S. Navy.

A graduate of Ohio State University, Dr. Ekey began his industrial engineering experience in 1941 as a precision inspector for the Murray-Ohio Manufacturing Company of Cleveland.

WAXES
continued from page 60

apparent that these wax compounds not only differ greatly among themselves, but also differ from any one grade of straight petroleum or natural wax. They all have low penetration hardness values at room temperatures, but vary to a considerable degree in many other respects. Fundamentally, this variety of wax pattern materials results from the fact that patterns of different dimensions and design require waxes prepared to different specifications.

The expansion and contraction characteristics of wax compounds shown in Table 2 are of importance because low values help to establish and maintain close tolerances in the finished metal castings. The values are reported as percent volume expansion from 80 F. to various temperatures. These expansion values are plotted against temperatures in the graphs which also follow in Figures 1 and 2.

The overall expansion (on heating) or shrinkage (on cooling) between liquid and solid state is not a true designation of the shrinkage that may be found between the injection and the "freezing" temperatures of a pattern material. The factor of importance is not how much the wax contracts from melt temperature to solid phase but how much is inherent from semi-molten (mushy or injection temperature) to the solidus point. Even between these two points the actual contraction of the disposable patterns will be less than that indicated by these values if the compound continues to flow into the die during a major portion of the dwell period.

Good flow properties and properly controlled temperature range during any dwell or injection period can compensate for high contraction; however, good flow and a low order of contraction are the ideal combination. A further method by which this particular problem of contraction has been overcome in patterns of large cross section is by the insertion of a solid wax "blind" into the center of the mold cavity and around which molten wax is injected.

In explanation of the characteristic curves which represent

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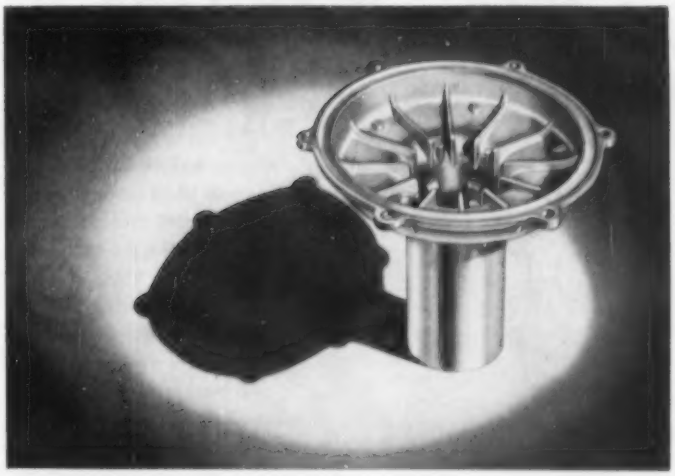

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the temperature vs expansion performance of these wax compounds, it is interesting to note the three-phase behavior in the graphs in Figures 1 and 2.

1. Dilation is slow at first while the wax expands as a solid—from room temperature to the point at which its first components begin to liquefy.

2. Rate of expansion is more rapid as the wax undergoes the change from a complete solid to a complete liquid During this range some components continue to expand as solids until the last, whereas others expand as liquids following their melting earlier in the range.

3. Dilation slows down again in this range where all the wax expands as a complete liquid—above its melt point.

A Look Ahead

The industry of investment casting is making rapid strides as it takes its place in the production economy. Potential customers and others are being educated to its advantages, and such problems as standardization of specifications and quality control are being vigorously attacked.

In looking ahead it becomes quite apparent that precision investment casting as an industry is just beginning to build up momentum.

NEW SALES OFFICE

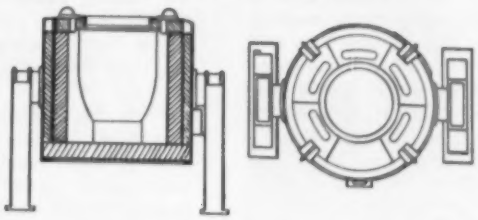
The Samuel Greenfield Co., Inc., smelters and refiners of brass, bronze and aluminum ingot, of Buffalo, New York, has announced the opening of a new sales office, under the direction of Edward H. Burgess, Jr., in Providence Rhode Island.

FIVE COMPANIES JOIN ICI

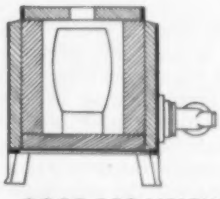
The election of five new members to the Investment Casting Institute, Chicago, is announced by V. S. Lazzara, Institute pres.

Companies and their official Institute representatives include: Dean Precision Casting Company, Minneapolis, Charles Bader representative; Lawrence Laboratory, Santa Monica, California, Lawrence Schwedes, representative; Carbide & Carbon Chemical Company, New York City, Charles McClelland, representative; Montrose Chemical Company, Newark, N. J., B. L. Rothberg, representative; and Stratos Division, Fairchild Engine & Airplane Company, Bay Shore, Long Island, F. William Cook representative.

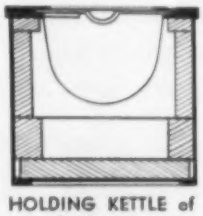
3 BASIC TYPES OF FURNACES COMPARED



1. COVER ARRANGEMENT on this type of furnace makes it suitable for melting aluminum alloys, by minimizing hydrogen pick-up. Cover permits vapor pressure to escape around the perimeter. Round rolos or slits are equally good as escape ports.



2. GOOD FOR MELTING copper, but not recommended for aluminum, is this design whose center escape vent creates heavy vapor pressure and increases hydrogen pick-up.



3. HOLDING KETTLE of this type facilitates production of small castings. By fast melting in crucible furnace and transfer to holding kettle, metal is not chilled by cold ingot.

An Experienced Metals Man Advises . . .

How To Melt And Cast Aluminum Alloys

BY FRANK J. DANIELS
Product Development Director
The George Sall Metals Co., Inc.

WE believe this subject to be a timely one since the cost of metal, labor and administrative expenses has increased considerably in the last few years. Furthermore, casting customers are now demanding higher quality casting at lower prices. In view of this, it is important for all foundries and casting shops to continually strive toward the goal of producing better castings at the lowest possible cost.

While this article pertains to melting and casting aluminum alloys there are some extremely important prerequisites that that should not be overlooked.

1. *Specifications* — If possible try to have your customers, or their engineers discuss the contemplated castings with you. Have them advise as to application, strength, pressure tightness, tolerances, machinability, finishes or any other special objective they wish to accomplish. This will help in selecting the proper alloy.

2. *Pre-Planning*—Explain to them the various difficulties that might be encountered with the design they have in mind. Suggest whatever you can to reduce costs without impairing the qualities desired. Do not hesitate to make recommendations, for in most instances this will be appreciated.

3. *Alloy Selection* — If the situation arises where help is desired from a metallurgical standpoint consult your ingot supplier, who has experience in selecting alloys for many purposes. Mention of this is made because in many cases foundries have been noted using alloys which were not designed to do the required job satisfactorily. Then again some complaints from casting customers are received by the producers of castings relative to low strength, low elongation, discoloration, poor machinability, leakers, etc., much of which could have been avoided by selection of the proper alloy before the job was started.

4. *Good Dies and Patterns* — The next important issue is the quality of patterns and dies. No stone should be left unturned in making prospective casting accounts appreciate that castings can only be as good as the pattern or die from which they are produced. Trying to save a few dollars on patterns and dies can be disastrous to both the foundry and the customer.

5. *Put It in Writing* — When all has been decided on, try to have the desired specifications written up, be they short or long. Failure to do this causes a great deal of misunderstanding and can result in the loss of a good customer.

At this point you are ready to give serious consideration to production at the lowest possible cost without impairing any of the qualities set forth in the specifications.

Furnace Selection

The proper furnace is extremely important.

For a sand or shell mold foundry there are several types of gas, oil and electric furnaces. In the East, oil and gas fired furnaces seem to predominate.

One important thing to remember is that any furnace should melt the metal as fast as possible. Consequently fast melting units are desirable. Basically for firing by gas and oil, use a furnace which is specifically designed for melting aluminum, such as shown in Figure 1. Do not select a furnace designed as shown in Figure 2 which is used extensively for fast melting of copper base

Continued on next page

MELTING ALUMINUMS—cont.

alloys. The reasons for selecting the furnace in Figure 1 include several factors.

The cover arrangement on this furnace allows the flame and resultant vapor pressure to escape from the furnace perimeter rather than through a hole in the crucible cover, as in the furnace shown in figure 2.

Hydrogen gas absorption increases with higher temperatures and increasing vapor pressure. Consequently, by keeping vapor pressure over the metal bath as low as possible, the amount of hydrogen pick-up for any given temperature is reduced. (This is not as important when melting copper base metals since they will absorb both hydrogen and oxygen from the water vapor, but hydrogen can be kept to a minimum by melting with an oxidizing flame.) This cannot be done with aluminum and aluminum alloys, since aluminum has a high affinity for oxygen and combines with it to form aluminum oxide, or dross.

The hydrogen is soluble to varying degrees in molten aluminum and insoluble in the solid metal causing gas holes to appear when the casting solidifies. Hence reduction of vapor pressure by having no flame impingement is conducive to good aluminum melting practice.

From the foregoing it can also be appreciated that a casting shop pouring many small castings can make good use of a melting, or holding kettle such as shown in figure 3. This will permit fast melting in a crucible type furnace and holding at a constant temperature in the holding kettle.

Liquid metal is transferred at desired temperature to the holding kettle and consequently chilling by addition of new ingots or back scrap is avoided. This method is used by permanent mold and die casting shops where temperature control is critical.

If iron kettles are used, care should be taken to coat them with a suitable refractory to avoid iron pick-up in the aluminum bath because iron is quite soluble in aluminum at normal casting temperatures. Alorco Insulating Powder (or "red mud" as it is commonly called) has been found to work very well.

Electric furnaces of the low frequency induction type are also excellent for melting aluminum alloys. The very nature of their operation holds vapor pressures to a minimum and they may be operated with their covers closed except when adding metal. This helps to keep atmosphere or water vapor away from the metal bath and results in a great reduction in hydrogen gas pick-up. Also less dross is formed as metal is not exposed to flame and excess air.

The choice of an electric furnace, however, depends on the cost of electricity vs gas or oil. Consider also, if you intend to operate continuously the metal must be kept liquid in the furnace at all times or it will shut down.

One other factor to consider in a low frequency induction furnace is the possibility of tubes clogging due to oxide or sludge formations clinging to the tube sides. This necessitates continued watching and in most cases the tubes, or channels should be cleaned out about every two hours, particularly when running furnaces at capacity.

Most of the foregoing is applicable to the die casting and permanent mold shops. In addition however, the large die casting shops make use of reverberatory

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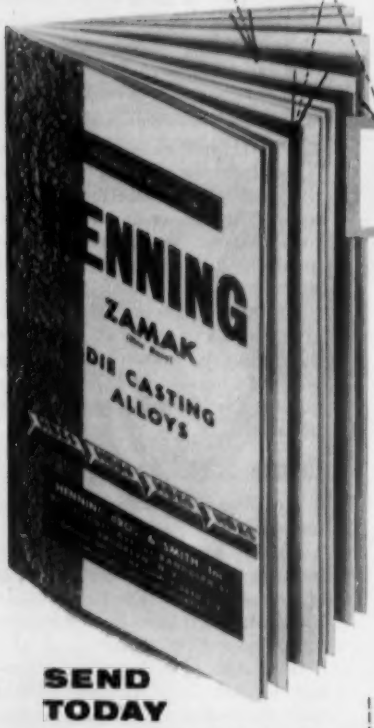

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furnaces, where metal is melted by heat radiated from the walls and roof of the furnace. These furnaces have good melting capacity at low cost.

On the other hand metal so melted is readily exposed to flame and water vapor. Consequently hydrogen pick-up can be high and frequent checks should be made for this. Also there is more metal loss due to drossing.

In the die casting industry, where in most cases wall thicknesses are thin and pressures high, it is hard to detect gas porosity. This means that not too much attention is given to gas pick-up by die casters. On the other hand when sections are die cast some of the porosity is due to hydrogen, and in this case an effort should be made to reduce it by good melting practice or degassing prior to pouring.

Sludge

Another problem generally encountered in the die casting industry is the formation of sludge. There is really no mystery about this. The sludge is composed of high melting constituents, such as aluminum-iron, aluminum-iron-Manganese, Aluminum-iron-manganese-chromium. Due to their higher melting points, these compounds freeze out at low temperatures; because they are heavier than aluminum they drop to the bottom of the crucibles or kettles. This generally takes place when operating temperatures fall below 1125 F. Even when casting at 1150 F, it is quite possible to chill the bath in certain areas by adding cold metal. This causes a drop in local temperatures resulting in freezing out the high-melting-point compounds. This can be practically eliminated by premelting in a breakdown furnace and pouring liquid metal at 1150 F to 1200 F into the holding furnace.

The sludge can be formed in the breakdown furnace by overloading its capacity, particularly if it is the kettle type. Metal must not be charged so rapidly that the bath remains quite cold in some areas for any length of time.

Generally speaking, more sludge is formed when iron melting equipment, not properly coated, is used. The greater amount of iron dissolved by the metal bath furnishes more to drop out when temperatures are low.

Hydrogen

Regardless of the furnace used,

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aluminum . . .

▶ permanent mold castings
▶ die castings

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THE EASTERN MALLEABLE IRON CO.
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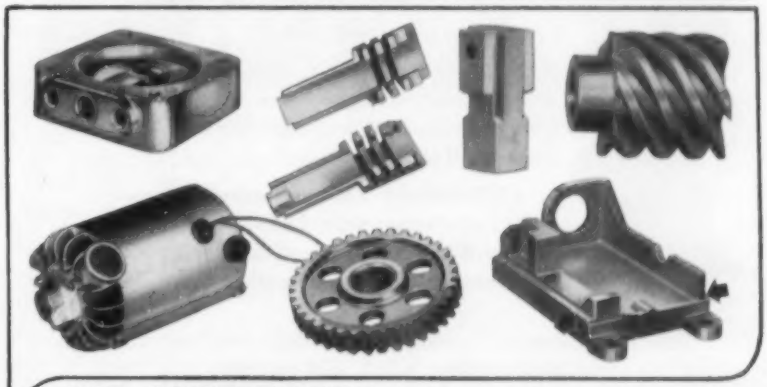

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or the manner in which aluminum alloys are melted, there is always the possibility of hydrogen gas pick-up. In view of this, and when good sound castings are desired, it is always best to degas the metal before pouring. Some shops use various chemical compounds or salts which liberate chlorine or fluorine which combine chemically with hydrogen to remove gas. When used properly and under careful control they can be helpful. However, most of these degassers are either hygroscopic or deliquescent and if left standing open to the air will pick up moisture. If they are then added to the metal, they will cause excess water vapor and actually result in more hydrogen pick-up, as well as increased dross due to agitation.

The best degassers are chlorine and nitrogen. The latter is generally preferred where ventilating equipment is inadequate since it is an inert gas and no chemical interaction takes place. We have found that dry nitrogen does an excellent job and, as it is comparatively cheap, no shop should be without it. When purchasing, "oil pumped dry nitrogen"—any other might contain some moisture and be detrimental. This can generally be obtained in cylinders from any local welding supply house.

Nitrogen is introduced to the metal through a fairly small diameter tube, generally graphite, although an iron tube can be used if it is coated to reduce the possibility of iron pick up. It is bubbled through the melt just rapidly enough to cause a slight surface rippling without spattering. The time involved to complete degassing will of course vary based on the volume of metal being degassed. Five to ten minutes is generally ample for heats of 200 to 300 pounds.

After degassing and checking pouring temperature, metal should be carefully skimmed so as to remove any surface dross.

7 Points To Remember

In addition to gas porosity many other factors can result in unsatisfactory castings. This can be due to improper sand conditions and there is a good deal of literature available on that subject.

However, gating, risering and pouring are extremely important and the following basic principles should be adhered to:

1. Metal should not be stirred or agitated in any way. It should

be poured as quietly as possible so as to reduce oxide and dross.

2. Molds should be gated so as to avoid any sharp corners, etc., enabling metal to flow smoothly. This reduces turbulence in the molds and results in smoother surface finishes.

3. As to temperature, good outside appearance is obtained by pouring metal as cold as possible without having misruns, or cold shuts. However when castings are to be machined, particularly where heavy sections are involved, it is necessary to pour metal hot enough so that it will continue to feed such sections during solidification in order to reduce the possibility of internal shrinkage, often mistaken for gas porosity.

4. When bubbles are seen just under the surface skin and generally on the cope side of sand, shell or plaster mold castings, these are not due to hydrogen gas pick-up but are almost always the result of air entrapment in the metal stream during pouring. This can be avoided by using a rectangular sprue, or increasing chokes immediately adjacent to the sprue so as to permit the sprue to be kept full at all times during pouring.

If this is not done, the metal will swirl in the sprue causing a vortex to be formed which draws air into the metal stream. No amount of venting will enable this entrapped air to escape. Be sure to pour continuously, not intermittently, and keep sprue filled at all times.

5. Pouring temperature is very important as it will affect the appearance and mechanical properties of the castings. In view of this, coupled with the fact that every casting presents a separate problem, we of course cannot recommend the right pouring temperature for each alloy here. It is best to pour a few castings at varying temperatures and then determine which is best, depending on finish and other properties desired.

Generally speaking, better finish and mechanical properties are obtained from castings having small grain size, not because of the size itself but the effect the fine grain has in dispersing inclusions.

When no grain refiner is present, grain size is the direct result of pouring temperature and cooling rate. Consequently, lower pouring temperatures result in finer

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grain and higher temperatures result in coarser grain. This applies to metal poured into molds which dissipate or extract heat but at the same rate. From this it can be understood that some molds will give a different cooling rate than metal molds or dies (always faster in metal molds). This explains why grain structure is better in castings produced in permanent molds or die cast.

As pouring temperature is so vital in controlling the quality of castings, it should be accurately measured with a pyrometer. Several types are available and any of the instrument manufacturers can furnish full information.

6. In sand and permanent mold castings, solidification shrinkage often presents a problem. Experience has indicated that many foundries in trying to cut down gates, risers, etc., go a little overboard. Then, in order to produce the casting with inadequate gating, they increase the pouring temperature, which, in turn, can cause more shrinkage, particularly where heavy sections are adjacent to thinner walls. It would be better to increase the size of runners and ingates so metal can be poured at a reasonable temperature, resulting in improved appearance, less shrinkage and better mechanical properties. However, care should be taken to see that metal is hot enough to feed casting internally so that no internal shrinkage develops.

Chills are also used in order to quicken solidification at heavy sections. They can be prepared from cast iron, graphite or other metals. Care should be taken to see that they are clean and dry, otherwise blows can result.

7. Cracking generally occurs after metal has set up or solidified in the mold. Certain alloys are more prone to this condition than others. Alloys high in silicon give less trouble. Higher iron contents are usually helpful but going over 1.00 per cent iron where metal is cast in sand is not recommended.

To reduce cracking, eliminate any resistance to the contracting metal. In sand this condition can be caused by too strong a molding sand or cores which do not readily collapse. Where heavy and thin sections are adjacent, cracking can also be encountered due to streases set up by abrupt change in section thicknesses. This condition can be minimized.

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Five small parts of this machine are plaster mold castings of OPC #40 bronze. Held within specified ±.005" tolerance, they require no finish machining — that's OPC accuracy and smoothness. The "teeth" on the underside of Part D are cast to match the thread of the screw feed — that's OPC preciseness of detail. We'd like to help solve your small parts production problems the same way!

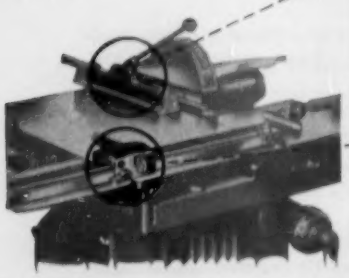
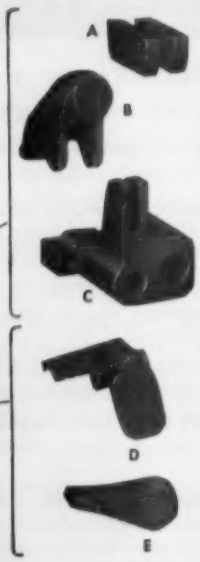


Photo courtesy Hammond Machinery Builders, Inc.



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The appointment of Kenneth M. Bartlett as executive vice president of Horizons Incorporated, industrial and governmental research organization, has been announced by Edwin T. Goodridge, Horizon's president, at the company's executive offices in Princeton, New Jersey.

Bartlett, the former manager of research of Thompson Products, Inc., will supplement the management team of Goodridge and Dr. Eugene Wainer, vice president and director of research, who have guided Horizons from its beginnings in 1946.

Bartlett was the founder and the first president of the Investment Casting Institute.

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Federated Metals

DIVISION OF AMERICAN SMELTING AND REFINING COMPANY
120 BROADWAY, NEW YORK 5, N. Y.
In Canada: Federated Metals Canada, Ltd., Toronto and Montreal

Aluminum, Anodes, Babbitts, Brass, Bronze, Die Casting Metals, Lead, Lead Products, Magnesium, Solders, Type Metals, Zinc Dust

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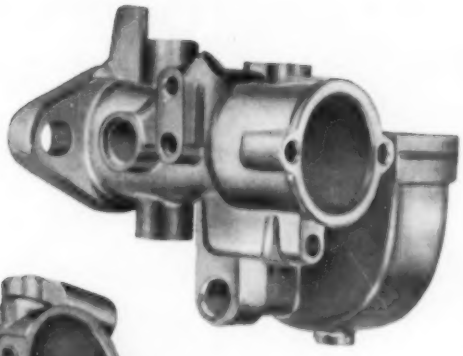
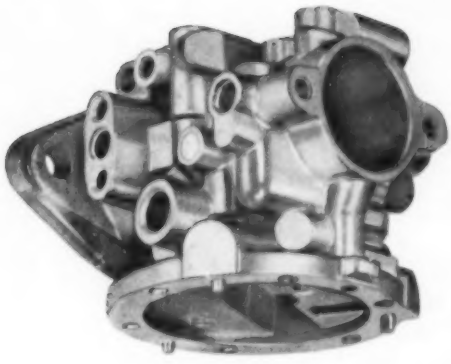
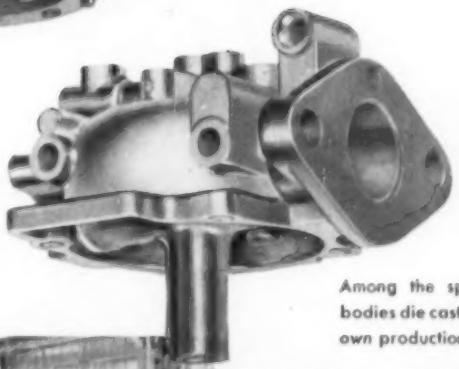
HUDSON BAY
SPECIAL HIGH GRADE ZINC – 99.99%
International Minerals and Metals Corp.
11 Broadway New York 4, N.Y.
One Fine Zinc For Die Casting





Tillotson Manufacturing Co. writes:

"DIE CASTINGS BY HOOVER help us make a much better product at a much lower cost"



These complex die castings, produced by Hoover for the makers of the famous Tillotson Carburetors, are notable for their intricate coring and many close tolerances. They contain holes on all sides which must be perfectly aligned, and sections of the castings must be free from porosity to prevent leakage.

The Hoover Company's complete production facilities for promptly meeting your requirements include 8 zinc die-casting machines, and 27 aluminum die-casting machines carrying ratings up to 400 tons. Castings can be produced from the smallest practical size up to 12" x 12" area and 8 lbs. weight for aluminum and 7" x 10" and 5 lbs. for zinc.

Among the specific advantages of having their carburetor bodies die cast by Hoover . . . advantages that may apply to your own production problems . . . The Tillotson Company points out:

- **Broader possibilities in engineering design.**
- **Saving in machining time due to large percentage of small holes cored to size and flat surfaces cast smooth.**
- **Saving of number of machines in production line.**
- **Longer tool life, fewer tools required.**
- **Cleaner to handle, less scrap in plant.**
- **Almost complete elimination of rejects.**
- **Smoother, neater appearance and strength with lightweight which have increased our sales tremendously.**

THE HOOVER COMPANY, Die Casting Div., North Canton, Ohio

Get a bid from

HOOVER

Specialists in the fields of die castings since 1922

Write for file folder, "Die Castings." Shows how to step up production and cut costs. Shows their advantages, how they are made, how they should be designed, how they help you step up production and cut costs.

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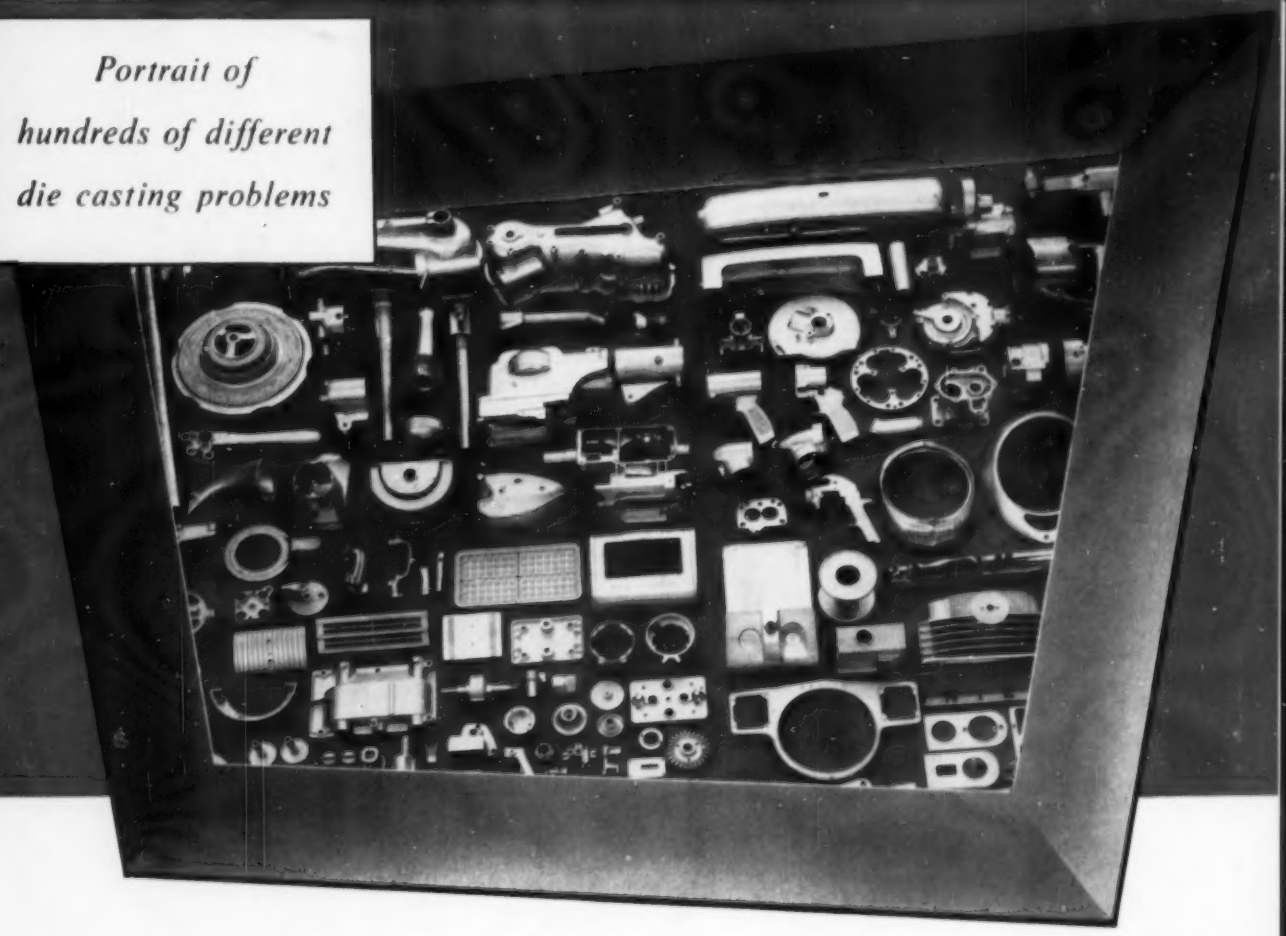
Portrait of hundreds of different die casting problems



solved with APEX die casting ALLOYS

aluminum and zinc

Apex quality ingot is making the die caster's job easier and his production more economical in hundreds upon hundreds of applications that have varying alloy requirements. Apex produces to specification—controlling quality with rigid electronic quantometer analysis throughout the melting and refining processes. Apex uses microscopic, macroscopic, radiographic and x-ray diffraction equipment to insure clean, gas free ingot of the proper grain size, fluidity and castability.

You can *depend* on the products and service of Apex, one of America's largest smelters and suppliers of aluminum and zinc alloys to the foundry industry. Specify Apex and know you're *right!*

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RESEARCH LEADERSHIP BACK OF EVERY INGOT

Send for our helpful booklet, "Die Casting Alloys." Shows composition, properties, other data on Apex products. No obligation.

APEX SMELTING COMPANY

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